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PREDICTIVE VALIDITY AND STABILITY OF MEASURES OF INTELLECTUAL POTENTIAL FOR TWO SAMPLES OF INDIAN-METIS AND ESKIMO CHILDREN

by

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies for acceptance, a thesis entitled "Predictive Validity and Stability of Measures of Intellectual Potential for Two Samples of Indian - Metis and Eskimo Children," submitted by Mohindar Singh Rattan in partial fulfilment of the requirements for the degree of Master of Education.

ABSTRACT

The main purpose of this investigation was to indentify culture-reduced tests which would show long-term predictive validity and stability for two samples of Canadian Indian-Metis and Eskimo pupils. Other problems investigated included the study of the relationships of both conventional and culture-reduced tests with background variables and current school achievement.

The Indian-Metis sample consisted of 45 pupils of both sexes who were in grades 1-3 at the Faust school, Faust, Alberta in 1961. The Eskimo sub-samples consisted of 62 and 37 pupils of both sexes who were in the age groups of $6\frac{1}{2}$ to $9\frac{1}{2}$ years and 10 to 12 years respectively at Inuvik and Tuktoyaktuk schools in 1962. Large batteries of tests were administered to these samples in the spring of 1965. Appropriate data of 1961-62 were utilized along with the 1965 data in order to test the four hypotheses of this investigation. Data analysis involved mainly Pearson product-moment correlations, multiple correlations and significance of differences in correlations.

The major findings of the study were as follows:

1. Culture-reduced tests such as Progressive Matrices, SCRIT and Lorge-Thorndike Non-verbal Level 3 have shown long-term predictive validity and stability for the Indian-Metis and Eskimo samples. Further, these culture-reduced tests, with very few exceptions, do not differ significantly from the more conventional

California Test of Mental Maturity Language and California Test of Mental Maturity Total in their predictive validity and stability coefficients for these samples.

2. Culture-reduced tests used in this study would appear to be relatively less related to background variables such as occupation of the parent and amount of language other than English used in the home than are the conventional tests (particularly those dependent on liguistic skills).

3. Culture-reduced tests administered to the samples in 1965 have shown moderate relationship with current school achievement which indicates that they sample from the abilities required for scholastic tasks. Differences in correlations with current school achievement for conventional and culture-reduced tests are not always significant for the two samples.

The culture-reduced tests were examined in relation to MacArthur's criteria for evaluation of instruments designed to measure intellectual ability in a variety of cultural settings. The tests meeting the criteria less badly than other tests have been identified.

Implications of the study for theoretical, practical and further research purposes were pointed out.

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CHAPTER I

THE GENERAL PROBLEM

The early efforts of psychologists at cross-cultural comparisons of abilities were crude and highly controversial. The test results of American Negroes, North American Indians and of children from lower socio-economic strata generally showed much lower scores than those of middle class urban European-American Whites. These scores were often interpreted as indicative of innate intellectual inferiority of these people. Many psychologists and sociologists, however, pointed out that these scores were a reflection on inadequate educational and social opportunities. Vernon (1965) cites investigations that show definite improvements in ability scores with improved economic and educational conditions.

Anastasi (1961) reports many studies that show the dependence of intelligence test scores on cultural differences. Children growing up in isolated communities, Indian reserves, Negro slums, in the homes of low socio-economic status people do not do as well on the conventional intelligence tests as the children from middle-class urban European-American homes. Anastasi infers that this disparity of scores is indicative of different cultural experiences rather than any innate differences in intelligence.

Klineberg (1951), in reviewing studies on American Indians, concludes that cultural background of the individual may determine

his general approach to the test situation in such a manner as markedly to influence his test scores. Havighurst (1951) is in agreement with other reviewers of the relevant literature when he states, "... middle class and lower class children bring to the intelligence test situation widely disparate cultural experiences".

A series of studies is being conducted at the University of Alberta under the general direction of MacArthur, in the general area of assessing intellectual potential with a minimum of cultural bias. These studies are attempts to identify those instruments which provide least invalid estimates of the intellectual potential of children from lower-socio-economic strata, from homes in which a foreign language is used, and from Indian and Metis communities. The present study is a part of this larger project.

Modern education philosophies require that instruction be adapted to suit the needs and abilities of individual children. This presupposes a fair estimate of their intellectual potential. MacArthur (1962) points out that the conventional group intelligence tests are available for this purpose so far as the urban middle class pupils are concerned, and asks:

> "How can a teacher gain a valid picture of the general intellectual ability of an immigrant, a slum child, an Indian and Metis, to assist in diagnosing his difficulties in reading or number and in applying teaching techniques appropriately adapted to that capability?"
>
> (MacArthur, 1962, p 1)

Assessment of intellectual potential is both diagnostic as well as prognostic. Given a fair estimate of the intellectual potential, we want to predict future academic or general success. Cronbach (1961) classifies tests on a bipolar continuum, one extreme of which is the cold-blooded predictors of school success, and the other extreme is the instruments designed to tap potential. The so-called cold-blooded predictors of school success are heavily dependent on vocabulary and information questions. The tests on the other extreme tend to minimize past learnings of specific type. Elley (1961) describes the virtues of an intelligence test which does not emphasize past learning of specific type. The potential usefulness of such a test can be seen in the improved classification of school pupils from city slums, rural backwoods or foreign cultures. The test of this type can also be useful for talent identification of unskilled adults.

The usefulness of a measure of intellectual ability is enhanced for guidance and counselling purposes if it shows a substantial long term predictive validity and stability. Conventional mental ability tests are known to be good predictors of academic success and to remain stable over periods of time. But what about culture-reduced tests of mental ability? In modern times, adaptive treatment is considered essential to help individuals from culturally handicapped environments realize their potential; and the usefulness of a culture-reduced test of mental ability that shows

promise as a least invalid measure of intellectual potential and which shows a substantial predictive validity and stability can not be overemphasized in such a process.

The general purpose of this investigation, as part of the previously mentioned Alberta series of studies, is to study a selection of promising culture-reduced tests with a view to assessing their predictive validity and stability for two samples of Faust Indian-Metis and Inuvik Tuktoyaktuk Eskimo pupils. In addition to the general purpose, some other relevent problems are also investigated.

CHAPTER II

REVIEW OF RELATED RESEARCH

It is generally recognized that all tests measure current developed abilities which invariably reflect the influence of prior learning. This would imply that children reared in superior educational and social environments will achieve higher scores on ability tests than children reared in inferior environments. This implication is borne out by many studies from Binet's generation to the present day. These studies have revealed a marked positive relationship between the measured intelligence of school children and their socio-economic background. Binet himself recognized this and attributed the differences in measured intelligence of children, at least in part, to social conditions. In relation to lower class inferiorities Binet (1916) pointed out,"some probably are acquired and result from unavoidable and accessory circumstances, others are probably congenital."

Although psychologists agree that tested intelligence is related to social circumstances, there is no unanimity of views concerning the reasons for the relationship. Some describe the discrepency of scores in terms of heredity, some in terms of environment, and yet some others describe it in terms of test bias and other systematic variations like test sophistication, motivation and so on.

Terman(1940) and Burt (1959) have argued for the major

importance of heredity. Burt concludes after statistical analyses of twin studies, foster children and social class differences that differences in average intelligence exhibited by the different socio-economic classes in England at the present time are mainly (seventy-five per cent), though not perhaps entirely the outcome of genetic difference. He subsequently raised the proportion to eighty-eight per cent still in favor of heredity (Elley, 1961).

Halsey (1959) points out that the distribution of innate intelligence among different social classes are due, not to genetic constitution, but soley to environment. Using the available information concerning social mobility he argues that variation in social structure is insufficient to account for the belief that the relationship between intelligence and social status is attributable to hereditary causes.

A third interpretation of the relationship between intelligence and social class is in terms of cultural bias in the tests used. Eells (1951) has produced strong evidence to support the contention that the bias in test items exists, and that it tends to favor upper middle-class children. Havighurst (1951) after reviewing the relevant research concludes,

> "... middle-class and lower-class children bring to the intelligence test situation widely disparate cultural experiences, by virtue of their social-class experience, and that middle-class children get more out of themselves in the ordinary school test situation than do lower-class children."
>
> (Eells, 1951, p 21)

That the conventional intelligence tests do not provide a valid estimate of the intellectual potential of children from low socio-economic status groups, Indians and Metis communities, and foreign language backgrounds, is also borne out by the previously mentioned Alberta series of investigations. The studies that correspond to these findings are those of Elley, West, and Olson respectively.

Prediction of School Achievement: The outcome of any prediction study is dependent on several factors including the criterion, the sample, the length of prediction interval, and the treatment offered the subject during the interval. Most studies available in the literature (including the present one) do not report adaptive treatment during the prediction interval. However, the evidence available from the local as well as other studies will be summarized in the following paragraphs.

Mosychuk (1965) reported a study by Cooper concerning the prediction of school achievement for grade 5 (N = 164) bilingual children. The correlations between the ability tests and the criterion (i.e. California Total achievement, Form AA, Elementary Level) were: Davis Eells games .53; IPAT Cattell Test of g.55; CTMM Total .64; Columbia Mental Maturity Scale .55; Leiter International Performance Scale .66; and Wechsler Intelligence Scale .77. It should be noted that the more conventional ability tests have higher correlations with the school

achievement than the less conventional tests. In an other study reviewed by Mosychuk, it is indicated that the conventional test CTMM Total is a better predictor of achievement than the Davis-Eells games. It is also reported that the children who are bilingual more frequently than others score higher on the Davis-Eells games than on the CTMM Total.

Mosychuk set out to determine the predictive validity of various ability tests in predicting grade 9 achievement for three Edmonton grade groups from various socio-economic levels. He concluded that the future achievement for the lower socio-economic group could not be predicted accurately with any of the ability or achievement tests used in the study. Culture-reduced tests improved prediction powers of the conventional tests more for the upper and middle groups than for the lower groups. Culture-reduced tests tended to be superior for the sample and for the groups when predicting to less verbal criteria such as grade 9 Mathematics and to some extent grade 9 Science.

Elley (1961) calculated correlation coefficients between end-of-year school average mark in grade VII and scores on intelligence tests administered four years previously for a sample of 243 Edmonton children. His median r's of the tests with school achievement were: Raven's Matrices .35; CTMM Language .31; CTMM Non-Language .23; CTMM Total .39; and CTMM Verbal .19. Elley pointed out that although these coefficients were low they

were in line with the assertion that culture-reduced intelligence tests might not be inferior to culture-loaded tests when prediction is to be a distant and changing criterion. It should be noted that the matrices showed a higher correlation coefficient than the CTMM Language and Verbal scores, and was nearly as high as the Total score.

Elley also studied the concurrent validity of his tests by correlating his test battery with end-of-year average school mark and found that the validity of the culture-loaded test was better than that of the culture-reduced tests. Such a result is to be expected when it is considered that verbal intelligence tests are often validated against criteria of school achievement. Consequently the predictive power of the culture-reduced tests is lower than that of the verbal tests, but in the opinion of Elley, the difference is not great enough to discourage their use with children who are handicapped, particularly if measures to reduce the handicap are taken.

West (1962) studied the concurrent validity of his test battery by correlating intelligence test scores with school achievement for two samples of Metis and Indian children. With few exceptions the correlations were significant and a great majority of them were substantial (i.e. .40 or more).

Numerous other studies have shown that correlation coefficients between tested intelligence and later academic achievement range from

.40 to .60 (Munroe, 1950).

Stability of Scores: The stability of mental performance has direct practical importance, since we can not make long-range educational and vocational plans if ability changes greatly. Evidence on stability is also of great theoretical importance, since it throws light on the nature of intelligent performance, and on the extent to which performance is predetermined by heredity and by events early in life (Cronbach, 1960).

Bayley (1949) re-tested children repeatedly from age one month to 18 years. It is seen from her results that the later a test is given, the more stable the I.Q. is. Tests administered before age two are unstable even over short periods. Test scores show a marked increase in long-range predictive power near age six. Other studies (Anastasi, 1961) also report that test-retest correlations are fairly stable at about .70 from the age of seven years onward.

Elley calculated the correlation coefficients between corresponding intelligence tests administered in grade III and VII for his Edmonton sample. The correlations were: Raven's Matrices .55; CTMM Language .49; CTMM Non-Language .33; CTMM Total .47 and CTMM Verbal .22. It is indicated that an intelligence quotient based on the Progressive Matrices would be at least as stable, if not more so, than an intelligence quotient obtained from the CTMM Total.

West (1962) hypothesized that the culture-reduced tests would show less decline with age than would the conventional tests for his two samples of Metis and Indian pupils. The finding, however, was exactly opposite to that predicted by the hypothesis. Over a five year interval for the Faust sample, greater changes in performance occured on conventional tests than on culture-reduced tests. The Fort Simpson replication tended to support the finding of the Faust study. On the basis of this cross-sectional evidence, West concludes that culture-reduced tests are more stable, have been less affected by alteration in environment over the five year period, than are the conventional tests.

Olson (1962) on the basis of his study on bilingual children reported that the culture-reduced test Progressive Matrices tended to remain fairly constant while the conventional CTMM test scores tended to either increase or decrease over the four year period. This observation was based on the fact that the variances of the differences between grade III and grade VII scores for the Progressive Matrices was significantly smaller than the corresponding variance for the CTMM Language. The mean scores of the two tests, however, did not show any significant differences.

Other Findings: Elley (1961) designed a study to investigate the extent of socio-economic bias in selected intelligence tests, with a view to identifying instruments which measure general

intelligence with a minimum of cultural bias. It was found that (a) verbal intelligence tests showed significantly higher correlation with socio-economic status than the selected culture-reduced measures, and (b) if some items were unsuitable for estimating the intellectual ability of lower-class children, they were more likely to be of a verbal nature.

Elley predicted that correlation between socio-economic status and a culture-loaded test (the CTMM) would increase significantly between grades III and VII. On the other hand a culture-reduced test should show correspondingly little increase in correlation with socio-economic status during the same period. This prediction was based on the assumption that if socio-economic status were an ongoing environmental influence on test scores, it could be expected to increase its effects as the testees grew older. The results pointed out that the Progressive Matrices showed a negligible change in correlation with socio-economic status, while CTMM Total score showed a significant increase.

Of the tests studied by Elley, Raven's Progressive Matrices was identified as the most useful culture-reduced measure of intelligence. The Cattell test of g and the Lorge-Thorndike Figure Analogies tests were ranked next.

West (1962) designed an investigation to study the effects of cultural background on selected intelligence tests with a view to identifying instruments which, in cross-cultural administration, validly measure intellectual potential with a minimum of cultural

bias. Appropriate analyses revealed the usefulness of Progressive Matrices, Cattell, SCRIT, CTMM Non-language, and Lorge-Thorndike sub-tests at the various grade levels as the least invalid measures of intellectual potential.

CHAPTER III

THEORETICAL FOUNDATIONS

The Nature of Intelligence

Psychologists have always had difficulty in defining "intelligence" in precise terms. The difficulty involved is similar to what the physicist encounters when asked to state what he means by time or energy, or the biologist what he means by life. The fact is that energy or life are intangible entities. We know them by their effects and properties. The same is true of general intelligence. The best we can do is to study its effects as evidenced in human behaviour.

There is no unanimity among psychologists on the definition of intelligence. It has been variously defined as the ability to learn, the capacity to adapt to new situations, the ability to educe correlates, and the like. Wechsler (1959) defines intelligence as the global capacity of the individual to act purposefully, to think rationally and to deal effectively with his environment. It is considered 'global' capacity in the sense that it is composed of different abilities which, though not entirely independent, are qualitatively differentiable. To Burt (1955), intelligence is a mental trait of fundamental importance and is innate, general and cognitive ability. Garret (1946) emphasizes abstract and symbolic intelligence since his definition includes at least the abilities

demanded in the solution of problems which require the comprehension and use of symbols- numbers, diagrams, equations, formulas which represent ideas and relationships ranging from the fairly simple to the very complex. The majority of the earliest writers have largely assumed the unitary nature of intelligence, but the recent research has emphasized the multiple factor approach (Bischof, 1954).

Hebb (1949), in an attempt to clarify the meaning of intelligence, distinguishes between intelligence A and intelligence B. Intelligence A is the innate potential which is dependent on genetic endowment while intelligence B is the present level of intellectual functioning which is the product of intelligence A and the totality of environmental experiences, which stimulate, thwart, and direct organized behaviour development. West and MacArthur (1964) proposed the concept of intelligence A' - present potential or capacity for future development. The essential difference between A' and B at a given time is that A' refers to the potential or capacity for future development given novel and optimum treatment. Intelligence B on the other hand refers merely to the level of presently developed and functioning intellectual abilities.

The Development of Intelligence

An individual starts out in life with a certain genetic make up. This genetic possession is what Hebb calls intelligence A- the innate potential. The actual functioning intelligence may be considered as an outcome of the interaction of the native potential, physical environment and motivation. Miner (1957) points out that the functional intelligence is developed to an extent that depends on the degree of native potential, the richness of the environmental stimulus potential, and strength of motivation to learn from what the environment provides.

Vernon (1965) stresses the importance of environmental variables for intellectual development and suggests that the schemata a child acquires, the way he perceives things, and his concepts and thinking techniques depend on his particular environ -ment, his family and tribal training, and the language structure of his society. This theoretical concept is also expressed by MacArthur (1962) when he states that differences in intellectual ability 'result from interaction of innate predisposition and environment in a multiplicative rather than additive manner'. In this investigation, therefore, the present level of intellectual functioning is assumed to be the joint product of heredity and environment.

The importance of interaction between organism and environment in the development of intellectual functioning is

emphasized by both Piaget and Hebb. Hunt (1961) explains Piaget's 'continuous creative interaction between the organism and the environment' as follows:

> "This interaction functions outwardly as adaptive coping and inwardly as organization. The adaptive interaction between organism and environment involves two complementary processes corresponding to inner organization and outer adaptation, which he (Piaget) calls assimilation and accommodation. In the course of this dual adaptive process, the ready-made reflexive schemata of the new born infant becomes progressively transformed through differentiations and co-ordinations into the logical organizations (or operations for information processing) of adult intelligence."
>
> (1961; p 111-113)

Both Piaget and Hebb see behaviour and intelligence determined by central processes. Both see early experiences as of probably crucial importance in determining both the rate and the final level of ability. There is a great deal of evidence that environmental deprivation and depressing emotional climate restricts the development of intelligence (Goldfarb, 1955).

Piaget (1963) theorizes that there is continual and progressive change in the structures of behaviour and thought in the developing child and that there is a fixed nature of order in which the successive structures make their appearance. This hypothesis gets some support from Bayley (1957) and Wechsler (1958) who found that different intellectual functions develop at different rates with different ages contributing maximally to their total development. This would suggest that the development of an intellectual function is most efficient at a certain stage of total development. Bloom

of Chicago, as reported by Chauncy (1964), estimates that extreme environments each year in the first four may affect the development of intelligence by about 2.5 I.Q. points per year, while extreme environments during the period of ages 8 to 17 may have an affect of only .4 I.Q. points per year. This observation is in agreement with Hebb's contention that early experiences are of crucial importance in determining ability.

In a review of both theory and evidence regarding the development of intelligence, Hunt (1961) has concluded that 'the assumptions that intelligence is fixed and that its development is predetermined by the genes are no longer tenable.' He continues:

> "It is no longer unreasonable to consider that it might be feasible to discover ways to govern the encounters that children have with their environments, especially during the early years of their development, to achieve a substantially faster rate of intellectual development and a substantially higher adult level of intellectual capacity".
>
> (Hunt, 1961, p 363)

The foregoing paragraphs lend support to the critical period hypothesis of development of intelligence. The critical period hypothesis holds that various kinds of circumstances have effects when they occur at one period but not when they occur at another period. Both Piaget and Hebb suggest that it is during the early years of life, while a large part of the brain is still developing, that basis for all complex psychological processes of

perceiving, learning, and remembering are laid down. Although this may contribute maximally to the development of an intellectual function there is considerable evidence that the level of intellectual abilities may to some extent be modified during the adolescent years. Studies reported in West (1962) are in agreement with the contention that better schooling and stimulating environment can to some appreciable extent offset the adverse effects of early deprivation.

Sources of Difference in Measured Intelligence

Variations among individuals in their test scores in an intelligence test have long been recognized. Numerous hypotheses about the nature of this variation have been suggested. Cattell (1941) regards the variation as depending on genetic endowment, individual's cultural training and experience, cultural medium in which the test is expressed, test sophistication, fluctuations in the underlying general ability itself, and chance errors in measurement. Tyler (1953), while commenting on the positive correlation between socio-economic status or social class and measures of general intelligence, suggests that the various factors responsible for the relationship are genetic differences, environmental differences, test bias, and motivational patterns of different social classes. It is further suggested that these factors are not mutually exclusive but may operate together in various combinations.

Elley (1961) has reviewed and summarized professional opinion on the causes of differences in measures of intelligence between different cultural groups. It may be noted that three main variables are regularly used to account for the variance in measures of intelligence:

a. Hereditary differences

b. Differences in opportunity to develop intelligence

c. Cultural bias both in regard to test items and test sophistication and motivation.

In this study multiple causation is assumed and no variable is overstressed to the exclusion of other. Each of the variables is considered as a significant contributor to the difference in measured intelligence.

Intelligence regarded Statistically

Spearman pioneered the factor analytic movement of modern psychometric research. He demonstrated the presence of the general ability factor, an important statistical concept which could account for majority of the variance of many test results in the cognitive domain. He proposed his two factor theory to explain the positive correlation between mental abilities.

Spearman's two factors are the 'g' factor and the 's' factor. 'g' is common to majority of cognitive tasks and 's' is specific to the task involved and can be considered as independent of the general factor and of all other specific factors. From the observations of

tests loaded with 'g', Spearman concluded that the essential characteristics of g behaviour are 'eduction of relations and correlates'. Bischoff (1954) points out that Spearman and advocates of his theory later named at least five group factors such as verbal ability, numerical ability, mechanical ability, attention and imagination.

American research lead by Thurstone, Guilford and others revealed many more group factors of ability, their appearance depending chiefly upon the composition of the population sampled, and on the kinds of tests used in the battery. Thurstone proposed a dozen group factors which he described as 'primary mental abilities'. Guilford (1959) postulates as many as 120 or more intellectual factors in his scheme which he calls 'the structure of intellect'.

Elley (1961) discusses studies that made compromise of the American analysts with the English analysts possible. The reconciliation advocated by Burt, and well described by Vernon (1950) has been widely accepted. The statistical model described by Vernon (1960) has at the top of the hierarchy a general intellectual ability factor 'g'. At the next level of hierarchy major group factors such as verbal educational (v:ed) and mechanical practical (k:m) are found. These group factors may further be thought of as giving rise to minor group factors and specific factors. This viewpoint implies that most of the test

variance is acoounted for by 'g', and to account for the variance over and above 'g', the group factors are invoked. Research literature seems to corrobrate this implication (Vernon, 1960).

Elley (1961) reviewed literature on the usefulness of the construct 'g' and concludes as follows:

> "g as a statistical construct can be well estimated in relative isolation from group factors. If the appropriate analytic techniques are employed, g appears invariably whenever a broad sample of mental tests is administered to a hetrogeneous group. It is exemplified in behaviour of a complex rather than a simple kind, is relatively stable and independent of differences or changes of environment and is of considerable value in predicting to non-specific criteria. Many test constructors, ...use it as a criterion for intelligence test design".
>
> (Elley, 1961, p 52)

Cross-Cultural Testing

Testing of individuals from different cultures or sub-cultures presents a problem. 'Culture-free' or non-language tests have been designed in an effort to overcome the difficulty. Cattell (1940), in his test, used a number of objects and processes common to various cultures. Davis and Eells (1953), in the construction of their culture-fair test, attempted to keep previous experiences constant by selecting items from a number of socio-economic levels thus trying to make the test fair to members of all levels. There is conflicting evidence as to the worth of these tests. It may be noted that no test can be entirely free of environmental influences. Furthermore, any test tends to favourindividuals from the culture

in which it was developed. The mere use of paper and pencil or the presentation of abstract tasks having no immediate practical significance will favour some cultural groups and handicap others.

Schwarz (1963) outlined principles in adapting group tests as measures of intellectual potential with a minimum of cultural bias. He proposed that test items should have adequate environmental supports i.e. they should require the application or generalization of knowledges and experiences that the examinee possesses. If, however, the environmental supports are inadequate or are not fully known, more emphasis should be placed on measures of general ability i.e. culture-reduced intelligence tests and especially at the primary level.

It may be noted that the whole structure and content of intelligence tests are culturally conditioned. The attitudes and skills involved in understanding instructions and formulating responses appropriate to the specific test situation may well be an important source of variance on test performance. Schwarz (1963) suggests that testees be familiarized in the required form of response before the test proper starts.

Tests can be described in terms of their structure and use. Some tests emphasize past learning whereas others (the culture-reduced variety) tend to minimize past learning of specific types. Cronbach (1960) describes tests in terms of a spectrum ranging from those which are strictly measures of outcomes of

education to those which are most independent of specific instruction. At the one end of the extreme are tests that have maximum educational loading and at the other end of the extreme are tests that have low educational loading. Educationally loaded tests are designed for cold-blooded prediction of future school success where as the tests on the other extreme are designed to locate undeveloped potential that novel treatment may bring out.

Anastasi (1961) describes ability tests in terms of a continuum which is somewhat similar to Cronbach's 'spectrum'. Tests with maximum educational loading are used to assess proficiency in special areas and tests with minimum educational loading are used for assessing intellectual potential. Between these two extremes are tests that find use for intermediate purposes.

Davis (1951) argues that the tests dependent on past learning and school-related behaviour deny a fair opportunity to many children. Teachers encourage students who do well on mental ability tests and accept the poor performance of children on these tests as indicative of low potential and make no deeper enquiry. In keeping with this argument, tests that have a minimum overlap with school achievement are preferable when it is necessary to compare persons from different educational and cultural backgrounds. In addition to their importance for assessing the potential of children from culturally handicapped backgrounds, tests with minimum educational loading (i.e. the culture-reduced tests) may be of value in the

identification of underachievement.

Good (1954) points out that we can not measure ability directly; what we measure is performance from which we infer ability, from which we infer capacity. In agreement with this view point West (1962) suggests:

(a) all ability tests measure performance

(b) from this measure we may infer intelligence B - the present level of intellectual functioning

(c) under certain conditions, from intelligence B, we may infer intelligence A' - intellectual potential for future development of intelligent behaviour.

Elley (1961) describes general characteristics of a test instrument designed to tap potential in cross-cultural settings. Such an instrument should have the following features.

(a) It should have a high loading on the general intellectual ability factor and negligible loadings on verbal, numerical, and other group factors.

(b) It should have lower correlations with background variables than conventional verbal intelligence tests.

(c) It should consist of items that can be solved in any language or mode of expression, and which are likely to be as familiar and useful for one cultural group as another.

(d) It should show relatively little decline with age for children from culturally handicapped backgrounds.

(e) It should show a regular pattern of item descrimination across all socio-economic levels.

(f) It should show moderate relationship to school achievement.

Summary

1. There is no agreement on the definition of intelligence. Early writers stressed its unitary nature while recent research has emphasized multiple factor approach.

2. Differences in intellectual ability 'result from interaction of innate predispositions and environment in a multiplicative rather than additive manner'.

3. Variables which may account for variance in measured intelligence among children from different cultural groups are:

(a) hereditary differences

(b) differences in opportunity to develop intelligence

(c) cultural bias of the test

(i) item dependency on information or skills that not all children have had equal opportunity to acquire

(ii) dependence upon acquired personality factors more likely to be developed in one culture than another, e.g. motivation, work habits, and so on.

4. Work of Piaget and Hebb lends support to the critical period hypothesis and suggests that early years of life are of crucial importance for the development of intelligence.

5. Notwithstanding what is said in #4, there is evidence that betterment of educational and social environment improves the level of functional intelligence even as late as adolescence.

6. The attitudes and skills involved in understanding instructions and formulating responses appropriate to the specific test situation may well be an important source of variance on test performance.

7. Tests heavily loaded with the general intellectual ability factor and having minimum educational and cultural loading provide our best estimates of intellectual potential for culturally handicapped children.

CHAPTER IV

DEFINITIONS, POSTULATES AND HYPOTHESES

I. Definitions

General Intellectual Ability - the present level of intellectual functioning which results from dynamic interaction of genetic endowment and the totality of environmental influences, which stimulate, thwart, and direct organized behaviour development.

Intellectual Potential - the present potential of an individual for future development of intellectual functioning. For the purposes of this study, intellectual potential will be defined as the ability measured by culture-reduced tests which tend to meet MacArthur criteria (see postulate 4) less badly than others.

Culture-reduced intelligence tests - the tests which are less dependent on past learning of specific types and consist of items that are of relatively equal familiarity to people from different cultures.

Conventional Verbal intelligence Tests - the tests which require verbal facility for understanding instructions, comprehension of problems, and for making responses. These tests possess a significant loading on the verbal factor.

Cultural bias - the extent to which a test discriminates between Indian-Metis and Eskimo children on the one hand and White children on the other hand.

Adaptive treatment - a procedure typically used in school whereby a special consideration is given to help children from culturally or socially handicapped environments. This special treatment can best be justified when the potential intellectual ability of these children is higher than that shown by conventional ability tests.

Predictive validity - directly related to the accuracy with which a measurement or a number of measurements will enable one to estimate some other criterial performance. This performance would be at some time subsequent to the original measurement or measurements.

Stability - the retest correlation obtained by administering the same test or similar test on two occasions.

Current School Achievement - due to differences in the test batteries administered to the Indian-Metis and Eskimo samples in this study, two different operational definitions of current school achievement will be used:

1. For the Indian-Metis sample, current school achievement will be defined as normalized standard scores derived from the Reading, Arithmetic, Language, and Total grade-placement scores on the California Achievement Tests, Primary, Elementary and Junior High Levels, Form X.

2. For the Eskimo sample, current school achievement will be defined as normalized standard scores derived from the Vernon Arithmetic, English and Vocabularly tests.

Metis - a child who, according to his teachers, is considered by the community to have Indian "blood in his veins".

Eskimo - subjects judged by their teachers to be of Eskimo parentage.

II. Postulates

1. Individual differences in measured intelligence are due to an interaction of the following variables in different proportions.

a. hereditary predisposition

b. environmental influences

c. content of test items

d. other systematic factors such as test motivation, test sophistication, and function fluctuation.

e. chance errors of measurement.

2. Tests and items which depend upon verbal symbolism and acquired information differentiate more clearly between cultural groups than do non-verbal reasoning tests.

3. Environmental influences affect measures of intelligence in two major ways: (a) by providing differential opportunities to develop intellectual capacities; and (b) by providing differential opportunities to learn specific information, skills, attitudes, work habits etc. required for successful performance on the test.

4. MacArthur (1964) has suggested the following nine criteria for evaluation of instruments designed to measure intellectual ability in a variety of cultural settings.

> "1. It should largely sample the broad factor of general intellectual ability running through a wide variety of European-American kinds of intellectual tasks, including arithmetic, linguistic, and reading achievement.
>
> 2. It should have negligible loadings on verbal, numerical, and other group factors. That is, it should sample general intellectual ability through simple basic symbols not very dependent upon particular previous learnings.
>
> 3. It should show less difference between cultures in cross-cultural administration than do alternative measures of intelligence.
>
> 4. It should show moderate relationship with current school achievement.
>
> 5. It should show evidence of stability under changed environmental conditions relative to that of alternative measures of intelligence.
>
> 6. It should minimize effects of test sophistication, providing plenty of appropriate practice experience, having directions depending little if at all upon language, and being unspeeded.
>
> 7. It should be reliable.
>
> 8. It should be practical and usable from an administrative stand point.
>
> 9. When and if possible, it should show long term validity as a predictor of success in intellectual tasks when appropriate adaptive intervening treatments have been employed."
>
> (MacArthur, 1962a, pp 5-6)

5. Conventional ability tests are heavily oriented toward school tasks and as such may be expected to predict school achievement better than the more general culture-reduced tests.

This study, as part of the previously mentioned Alberta series of investigations, has direct relationship to the studies of West (1962) and Elley (1961): consequently some of the definitions and assumptions listed above are adaptations of the definitions and assumptions from these studies.

It should be mentioned here that MacArthur criterion #9 (re predictive validity) implies adaptive intervening treatment. However, the treatment offered in Faust, Inuvik and Tuktoyaktuk schools is of the usual kind found in most schools. Although all teaching is adaptive to some extent yet the full implications of the criterion must await further study.

III. Hypotheses

The main purpose of the study is to examine test instruments in terms of their long-term predictive validity and stability for two samples of Faust, Alberta Indian-Metis and Inuvik Tuktoyaktuk, Northwest Territories Eskimo children. Definitions of culture-reduced and conventional tests are the same as used in the West (1962) study but for ready reference the 1961-62 predictors and 1965 mental ability tests are classified into the two categories as shown.

Culture-reduced Tests	Conventional Tests
Raven's Colored Progressive Matrices (Cld. P.M.)	Lorge-Thorndike - Primary (L.Th.)
Raven's Standard Progressive Matrices (Std. P.M.)	Detroit Beginning First Grade Intelligence Test (Detroit)
Safran Culturally Reduced Intelligence Test (SCRIT)	Otis Quick Scoring Mental Ability Tests-Beta Test, Form EM (Otis Beta)
California Test of Mental Maturity (CTMM) -Non-Language (N-L)	California Test of Mental Maturity (CTMM) -Logical (Log.)
-Spatial (Spat.)	-Numerical (Num.)
Institute for Personality and Ability Testing Test of 'g', Scale 2, Form A (Cattell)	-Verbal (Verb.)
	-Language (Lang.)
Lorge-Thorndike Intelligence Tests-Nonverbal, Level Three, Form A (L.Th.)	-Total
	Test of General Ability - Grades K to 2 & 2 to 4 (Toga)
MAC (Adaptations of Tests used in preliminary form by National Institute for Personnel Research in South Africa)	Vernon Oral Information (Oral Info.)
	Vernon Letters and Numbers (Let. & No.)
Gottschaldt Embedded Figures Test (Emb. Fig.)	
Otis Quick Scoring Mental Ability Tests-Alpha Nonverbal (Otis Alpha)	

The following hypotheses were set up to investigate the major problems mentioned above as well as some minor ones that are relevant to the general thesis.

Hypothesis 1 - Predictive Validity

(a) Both conventional and culture-reduced tests will have long-term predictive validity for the samples involved in this study.

(b) Conventional tests will have higher predictive validity than the culture-reduced tests for the Indian-Metis sample.

Hypothesis 2 - Stability

(a) Both conventional and culture-reduced tests will have significant stability coefficients over an interval of 3 - 4 years for the samples involved in this study.

(b) There will be no significant differences between the stability coefficients of conventional and culture-reduced tests for the Indian-Metis sample.

Hypothesis 3 - Background Variables

(a) Both conventional and culture-reduced tests administered in 1961-62 to the samples involved in this study will have insignificant correlations with sex in 1965.

(b) Conventional tests (particularly those dependent upon linguistic skills) administered in 1961 to the Indian-Metis sample will have significant positive correlations with the occupation of parent and significant negative correlations with the amount of language other than English used in the home in 1965.

(c) Culture-reduced tests administered in 1961-62 to the samples involved in this study will have insignificant correlations with the occupation of parent and the amount of language other than

English used in the home in 1965.

(d) Conventional tests administered in 1961 to the Indian-Metis sample will have higher positive and negative correlations with the occupation of parent and the amount of language other than English used in the home respectively than the culture-reduced tests administered at the same time.

(e) Correlations of the conventional tests with the occupation of parent and the amount of language other than English used in the home will change from 1961 to 1965 for the Indian-Metis sample.

(f) Correlations of the culture-reduced tests with the occupation of parent and the amount of language other than English used in the home will not change from 1961-62 to 1965 for the samples involved in the study.

Hypothesis 4 - Current School Achievement

(a) Culture-reduced tests, administered to the samples involved in this study in 1965, will have moderate correlations with current school achievement. A correlation is considered moderate if it is significantly different from zero and lies between .300 and .600.

(b) Conventional tests administered to the samples involved in this study in 1965 will have higher correlations with the current school achievement than the culture-reduced tests administered at the same time.

CHAPTER V

EXPERIMENTAL DESIGN AND PROCEDURE

The study is both longitudinal and cross-sectional in its approach. Test batteries of 1961-62 and 1965, consisting of culture-reduced tests, conventional tests, and achievement tests, are examined in terms of the various hypotheses. The longitudinal part is mainly concerned with the predictive validity and stability of the culture-reduced tests administered to the samples in 1961-62. The cross-sectional part of the study is mainly concerned with the relationship of mental ability tests and school achievement in 1965. Data analysis, in the form of inter-correlations of the various variables, was done on the University of Alberta IBM 7040 electronic computer. Other statistical procedures include multiple correlations, mean r's with school achievement, and the investigation of the differences in r's, multiple R's, and mean r's for significance.

R. S. MacArthur, of the University of Alberta, conducted mental ability surveys among the Indians and Metis at Faust, Alberta and Eskimos at Inuvik and Tuktoyaktuk, Northwest Territories in 1961 and 1962 respectively. The prediction and stability part of this study is based on these two samples and as such utilizes the appropriate data of 1961-62. During the spring of 1965, MacArthur again collected data on the Faust Indian-Metis and Inuvik and Tuktoyaktuk Eskimos. Large batteries of tests including those described in this chapter were administered to these two samples with the writer participating in the Faust test administration.

THE SAMPLES

1. Faust Indian-Metis sample: The Indian-Metis sample (N =45) for this study was extracted from the main sample, which consisted of 74 pupils of both sexes who were in grades 1-3 at the time of test administration in 1961 in the Faust school, Faust, Alberta. Faust is a rural settlement of about 1000 people and is located about 200 miles nothwest of Edmonton. Most of the pupils in the Faust school are from Metis and Indian families of very low socio-economic status, the mean Blishen Index being 37.8. Family life among the group is very unstable and common law marriages of limited duration are not unusual. English as a native language is hardly used in many of the homes.

In order to test the experimental sample (N =45) for representativeness of the main 1961 Indian-Metis sample (N =74), comparisons were made on the basis of mean grade, age, Blishen Index, language rating, and a few I. Q's based on both conventional and culture-reduced tests. These comparisons are set out in Table I. None of the differences is significant. Thus the hypothesis of no differences between the experimental sample and the main sample from which it is derived is accepted. This enables us to generalize the results of this study to the Faust Indian-Metis grades 1-3 pupils with a greater degree of confidence.

The outline of the number of subjects by grade, sex, occupational level of parents, and language rating, as well as range, mean, and standard deviation of the various descriptive statistics

for this sample, are reported in tables II and III respectively.

TABLE I

DESCRIPTIVE STATISTICS ON THE 1965 EXPERIMENTAL AND THE 1961 MAIN FAUST INDIAN-METIS SAMPLES.

	1961 Sample N = 74	1961-65 Sample N = 45
Mean Grade in 1961	1.82	1.89
Mean Age in 1961	8.6 years	8.5 years
Mean B. Index	37.5	37.8
*Mean Lang. Rating	3.3	3.3
Prog. M.I.Q.	102.4	102.3
CTMM Total I.Q.	88.8	89.9
Detroit B.I.Q.	89.2	89.0

* Mean of amount of language other than English used in the home: Coded 1 for never, 2 for hardly ever, 3 for quite often, and 4 for most of the time.

TABLE II

NUMBER OF SUBJECTS BY GRADE, SEX, OCCUPATION OF PARENT, AND LANGUAGE RATING FOR THE INDIAN-METIS SAMPLE IN 1961 AND 1965.

Variable	Indian-Metis	
	1961 Sample	1965 Sample
Grade 8		
7		10
6		14
5		18
4		2
3	12	1
2	13	
1	20	
Sex F	21	21
M	24	24
Occ. Lev.		
50 - 59		2
40 - 49	16	13
30 - 39	29	30
*Lang. Rating		
1	4	7
2	1	24
3	20	13
4	20	1
Total N	45	45

* The descriptive phrases for language rating were slightly different at the 1961 and 1965 testings. The respective codes are indicated below Tables I and III.

TABLE III

RANGE, MEAN AND STANDARD DEVIATION OF SOME DESCRIPTIVE VARIABLES FOR THE INDIAN-METIS SAMPLE, AS OF SPRING, 1965

Variable	Range	Mean	S.D.
Grade	3-7	5.67	.94
Age in months	116-183	150.27	15.60
Age when started school	5.5 to 8.5	6.45	.72
Total time in school	4.5 to 8.5	6.60	.91
Occupation	30 to 57	37.80	6.58
Amount of lang. other than Eng.*	1-4	2.18	.71
Sex (1 for girls, 2 for boys)		1.53	

*Coded 1 for English only, 2 for small part of the time, 3 for most of the time, and 4 for all of the time.

2. Inuvik and Tuktoyaktuk Eskimo Sample: The Eskimo sample is divided into two sub-samples based on different age groups. Sub-samples 2 (a) and 2 (b) consist of 62 and 37 pupils of both sexes who were in the age groups of $6\frac{1}{2}$ to $9\frac{1}{2}$ and 10 to 12 years respectively in 1962 in the selected schools at Inuvik and Tuktoyaktuk, Northwest Territories. The occupational level of the parents of pupils involved in this study is rather low, mean Blishen Index being 38.0 as compared to the Canadian average of about 50. Range, mean, and standard deviations of the various descriptive statistics are reported in Table V for these samples.

Table IV summarizes sample sizes, mean occupation indices and mean ages for the Indian-Metis and Eskimo sub-samples involved in this study.

TABLE IV

SAMPLE SIZES, MEAN OCC. INDICES AND MEAN AGES FOR INDIAN-METIS AND ESKIMO SAMPLES AS OF SPRING 1965

Sample	N	Mean occ. Index	Mean age
Faust I - M	45	37.8	12 years and 6 months
Eskimo 2 (a)	62	38.0	11 years and 3 months
Eskimo 2 (b)	37	38.0	13 years and 11 months

TABLE V

RANGE, MEAN AND S.D. OF SOME DESCRIPTIVE VARIABLES FOR THE ESKIMO SAMPLES, AS OF SPRING, 1965

Variable	Sample 2 (a) (N = 62)			Sample 2 (b) (N = 37)		
	Range	Mean	S.D.	Range	Mean	S.D.
Grade	1-7	3.71	1.13	3-8	5.84	1.55
Age in months	111 to 154	135.37	10.97	147 to 181	167.49	8.41
Age when started school	5.67 to 10+	6.67	.93	5.67 to 10	7.25	1.26
Total time in school	$1\frac{1}{2}$ to $6\frac{1}{2}$	4.58	.67	$3\frac{1}{2}$ to $9\frac{1}{2}$	6.33	1.7
Occupation	30 to 57	38.0	6.81	30 to 57	37.97	6.85
Plans for age 20*	3-8	4.1	1.26	3-6	4.1	1.19
Sex		1.63			1.46	

*Code is first digit only of Blishen Index

II. THE VARIABLES

1961-62 Battery of Tests

Most of the tests described below were administered to the Faust Indian-Metis sample in 1961; the colored Progressive Matrices, Otis Alpha Nonverbal, standard Progressive Matrices, and Lorge-Thorndike Nonverbal, Level III were the only tests administered to the Inuvik and Tuktoyaktuk Eskimo samples in 1962. Data on background variables were also collected for the 1961-62 samples. The variables studied were grade, Blishen Index, and home language rating for the Indian-Metis sample; and, age, grade, time in school, time in hostel, Blishen Index, and home language rating for the Eskimo sub-samples.

1. Lorge-Thorndike, Level I (1954) is designed for Kindergarten and Grade 1 children. The test consists of three sub-tests: oral vocabulary, cross-out, and pairing. Although it does not require reading, a good comprehension of oral language is necessary, especially for part 1. The alternate forms reliability coefficient for the total test is given in the Technical Manual (1957) as .81. An odd-even reliability coefficient of .92 is also reported by West (1962).

2. Lorge-Thorndike, Level II. (1954) is similar to Lorge-Thorndike, Level I, although somewhat more difficult. An alternate form reliability coefficients for the total test is reported in the

Technical Manual (1957) as .76. As an indication of validity, r's of .56 with Kuhlman-Anderson and .60 with the Otis at the grade III level are also reported. A correlation of .65 with the California Total achievement is reported by West (1962).

3. The Coloured Progressive Matrices (1947) is designed for use with children about five to eleven years of age. The test is largely perceptual and it seems to measure present capacity for intellectual activity irrespective of acquired knowledge. Burke (1958) reports re-test reliability coefficients of .8 for nine year olds. West (1962) reports a correlation of .91 with the WISC intelligence quotient for a group of grade 3 pupils. MacArthur (1960) found the test to have a high loading on the general intellectual ability factor and no loadings on group factors for a sample of 300 Edmonton grade 3 pupils. West (1962) found a correlation of .51 to .72 between the test and the California total achievement for grade 1 and 2-3. The test appears to be one of the most promising culture-reduced instruments available.

4. The Safran Culturally Reduced Intelligence Test (SCRIT), (1960) consists of 36 items of increasing difficulty. Each item is composed of a series of coloured geometrical figures which form a pattern according to some principle. One of the figures in the series is omitted. The task of the examinee is to select from a set of response options the one which completes the given series. Colour

is a significant factor in the principle upon which the series is based. MacArthur reported first principle axes factor loadings ranging from .55 to .92 for the SCRIT. He also reported correlations with California Total Achievement scores of from .35 to .49. As an indication of validity, r's ranging from .31 to .65 with his experimental battery used with grades 1-6 Indian-Metis pupils are reported by West (1962).

Evidence suggests that SCRIT like Progressive Matrices is one of the least invalid culture-reduced measures of intellectual ability.

5. The Detroit Beginning First Grade Intelligence Test (1937) was designed to assist in the classification of children in the first grade. The test consists of traditional types of items and is frequently used in schools. West (1962) reports a correlation of .76 with the Stanford-Binet, and a split half reliability coefficient of .91 based on a sample of 116 first grade pupils.

6. California Short-Form Test of Mental Maturity, (CTMM) Primary, (1953) consists of a set of seven sub-tests designed to measure four factors (i.e. Spatial Relations, Logical Reasoning, Numerical Reasoning, and Verbal Concepts) developed from logical rather than factorial constructs. The test can also provide separate scores for language and non-language factors.

The publisher reported split-half reliability coefficients of .88, .90, and .92 respectively for the language, non-language, and total scores. West (1962) reported this test (and its sub-tests) to have fairly high correlations with California Total achievement scores for the Faust Indian-Metis pupils. The range of these r's as reported is from .43 to .77.

7. SRA Tests of General Ability - Form A (grades K to 2 and grades 2 to 4) - are tests of general intelligence (or I.Q.). Each test consists of two parts. Part I tests the child's familiarity with the world around him through his experiences in the school, in the home and in the community. Test questions are in various fields of American culture, science, social studies, community affairs, and the arts. Part II avoids any cultural content; it presents geometric drawings designed to test the child's powers of abstract reasoning.

Buros Yearbook (1965) reports that the test correlation with other intelligence test scores range from .41 to .80 with a median of .62, its correlation with various achievement test scores range from .39 to .81 with a median of .58. Total score split half reliability ranges from .80 to .90 with a median of .87.

8. Otis Quick Scoring Mental Ability Tests - Alpha test (Nonverbal) was selected as an alternate culture-reduced measure of intelligence. The content of the test is entirely pictorial and geometric. The test is characterized by exceptional ease of administration and

scoring.

Split half reliability coefficients, as reported in the manual, are .87 and .88 for two samples of grade 3 pupils (N = 370 in each sample). Correlations between the test and the average of two Reading sub-tests of the Metropolitan Achievement Test for two independent samples, corrected for attenuation, were .69 and .68 respectively.

9. Standard Progressive Matrices (1956) - This test is non-verbal, unspeeded, intrinsically interesting and easily administered. Evidence from the Alberta studies and others suggests that this test is one of the least invalid measures of intellectual potential.

MacArthur (1964) reported first principal axes factor loadings ranging from .46 to .86 for samples of Indian-Metis pupils from villages in Northern Alberta and Northwest Territories. He also reported loadings of .60 and .42 for two samples of Rhodesian Africans. Elley (1961) obtained a 'g' loading of .71 and no other factor loadings for a sample of 271 Edmonton grade VII students. West (1962) reported correlations of from .51 to .72 between the test and California Total achievement for Faust, Alberta Indian-Metis grades 1-8 pupils.

Test manual reported re-test reliabilities ranging from .83 to .93 depending upon age and a correlation of .86 with Terman-Merrill scale.

10. Lorge-Thorndike, Non verbal, Level III, (1954) consists of three sub-tests: Figure Analogies, Figure Classification, and Number Series. An inspection of the items suggests very little dependence upon past learning of specific type.

The Lorge-Thorndike Total score had a very high g loading in Elley's factor analysis and MacArthur reported 'g' loadings ranging from .59 to .86 for the total test score.

An alternate forms reliability coefficient for the total test of .81 is reported in the manual. An odd-even reliability of .94 is also reported. As an indication of validity, correlations of .69 with CTMM Total, .62 with Kuhlmann-Anderson, and .66 with Otis tests are also reported. MacArthur found that correlation with the California Achievement test score ranged from .54 to .75 for grades one through nine.

1965 Battery of Tests

Most of the tests described below were administered to both Indian-Metis and Eskimo samples unless otherwise stated.

1. Standard Progressive Matrices (1956) see item #9 of the 1961-62 battery. The coloured Progressive Matrices was used to teach the subjects how to solve and record the problems presented by the test items.

2. Safran Culturally Reduced Intelligence Test (1960) see item #4 of the 1961-62 battery. In administering the SCRIT items 1 through six were used as teaching items so that with the four items given as practice items, a total of ten teaching items were used.

3. Lorge-Thorndike, Non-verbal, Level III (1954) see item #10 of the 1961-62 battery.

4. Institute for Personality and Ability Testing Test of g, Scale 2, Form A. (Cattell) - The test was originally designed as a culture-free test of the g factor. The test is largely perceptual in nature and consists of four sub-tests (i.e. Series, Classification, Matrices, and Topology). It is economical, easy to administer and can be given in less than twenty minutes.

Cattell (1958) reported a re-test reliability of .85 and split half coefficients ranging from .7 to .9 for different samples. In a factor analysis of eleven tests, Elley (1961) obtained a g loading of .79 for this test. MacArthur reported g loadings for the Cattell ranging from .55 to .79.

West (1962) reported correlations of this test with California achievement test scores as .45 and .56 for Metis children in grades 5-6 and 7-8 respectively.

5. California Short-Form Test of Mental Maturity, CTMM, Elementary Level, Form S - This test is similar to its primary level except

that it is more dependent on reading skills whereas at the primary level more importance is attached to listening for instructions.

The publisher reported split-half reliability coefficients of .95, .91, and .95 respectively for the language, non-language and total scores. Correlations of around .88 were reported between the CTMM Total and the Stanford Binet.

MacArthur found that the Non-language scores had g loadings ranging from .32 to .88. Elley found a g loading of .62 on CTMM Non-Language, of .58 on CTMM Language. CTMM Language had a v:ed loading of .62.

Correlations of the sub-tests with California Total Achievement scores range from .43 to .77 and from .31 to .80 for grades 2-3 and 7-8 respectively for the Metis pupils (West, 1962).

The CTMM was used with the Indian-Metis sample only.

6. California Achievement Tests, Primary, Elementary, and Junior High Levels, Form X - this test was used in order to provide measures of school achievement. The scores used were the grade placements in Reading, Arithmetic and Language. The batteries are well known and well standardized.

MacArthur reported g loadings ranging from .41 to .54 for these scores and Elley reported g loadings of from .36 to .44.

The Kuder-Richardson reliability coefficients for the sub-tests range from .83 to .95, and correlations with similar batteries

are encouraging enough to indicate good construct validity (Tiegs and Clark, 1957).

The primary level was used with grades 3 and 4, the elementary with 5 and 6, and the junior high with grades 7 and 8.

These tests were used with the Indian-Metis sample only.

7. The MAC Test - This test is an adaptation from tests used in preliminary form by the National Institute for Personnel Research in South Africa. The adaptation is done by MacArthur.

The first ten items of MAC 1 are used for teaching purposes and are intended to make sure that pupils understand (a) the principles involved and (b) the mechanics of selecting and recording answers.

Each item consists of a row of circles, triangles, and squares. These figures differ in size or colour. The task of the examinee is to choose two pieces from the choice sheet which would keep the pattern in each row going, and then to write the number of these pieces on the answer sheets in the right blanks. Any answer piece may be used more than once.

Carlson (1966) made a thorough study of the MAC and reported the general ability factor loadings ranging from .49 to .62 for it. He also found that MAC had moderate correlations with current school achievement for the samples involved with a very few exceptions. Split-half reliability coefficients range from .61 to .88 and r's with other tests are encouraging enough to

indicate construct validity.

8. Battery of Vernon Group Tests - Vernon of the University of London has developed a battery of group tests which he has been using in a variety of cultures around the world. The following tests were selected from his battery.

(a) Letters and Numbers Test - This test consists of a series of numbers, letters, and various combinations of these. At the end of each series there is a dot or dots indicating that a number or a letter or both are missing. The task of the examinee is to complete the series by providing the missing letters or numbers just above the dots. Carlson reported g loadings ranging from .81 to .87 for his samples. He also found that the test had substantial correlation with the achievement grade placements and scores for both Indian-Metis and Eskimo samples. Its r's with other tests of Carlson (1966) battery suggest good validity.

(b) Gottschaldt Embedded Figures Test - This test is another example of a culture-reduced test of mental ability. The task of the examinee is to find a figure embedded in a larger figure and trace it with a coloured pencil.

Carlson (1966) reported g loadings ranging from .68 to .82 for Indian-Metis and Eskimo pupils. The test is also reported to have significant correlations with current school achievement as well as with other ability tests.

(c) Oral Information Test - The test consists of 15 statements with a significant word underlined. The examiner reads these statements repeating the underlined words. Reading is done slowly and clearly with a pause of about four seconds between sentences. After the statements are read, the testees are asked questions on them and they write answers on the answer sheets. The order of the questions is different from the order of the statements. The procedure is repeated again but without re-reading the underlined words, and the scores of the two trials are added to form a composite score.

High loadings on the g factor are reported by Vernon for both the English and the West Indian samples as well as an educational loading for the former and Verbal-educational loading for the latter (Carlson, 1966). Carlson reported g loadings ranging from .44 to .89 for his four samples and a factor loading other than g for only one of his samples. Oral Information is also reported to have substantial and significant r's with current school achievement as well as with other ability tests.

9. Other variables included in the battery were:

(a) age, (b) grade, (c) total time in school, (d) occupation of parent - Blishen index for occupation (see Elley, 1961, Appendix B), (e) sex - 1 for females, 2 for males, (f) amount of language other than English spoken in the home

(coded 1 for none, 2 for small part of the time, 3 for most of the time, and 4 for all of the time).

For the Eskimo samples, items included were from (a) to (e) and plans for age 20 - first digit only of Blishen Index score for occupation.

10. Otis Quick Scoring Mental Ability Tests - Beta Test, Form EM. This test was included as an example of the conventional mental ability tests, likely to be culturally biased.

The manual reported parallel forms reliability coefficients of between .69 and .98 for various samples and split half reliability coefficients ranging from .89 to .94 for subjects in grades 4 to 8.

The Otis was used with the Eskimo sample only.

11. Vernon Arithmetic, English and Vocabulary Tests - These tests were included as measures of school achievement. The arithmetic test consists of both operations (i.e. addition, subtraction, multiplication, and division) and problems. The English test is an achievement test constructed for use in the West Indies, and the vocabulary test is the Mill-Hill junior form A.

Vernon reported that these tests have high g loadings (centroid) for samples of boys of the 11+ age in the West Indies and England. These tests also had loadings on an educational

factor for the English sample and a verbal-educational factor for the West Indian sample (Carlson, 1966).

The order in which tests were administered to both samples was chosen such that between-sample differences in test order effects were minimized.

III STATISTICAL ANALYSIS

Tests administered to the Faust Indian-Metis sample were scored by the writer while tests administered to the Inuvik and Tuktoyaktuk Eskimo samples were scored by the University of Alberta personnel under the supervision of MacArthur. All scores were entered on the record cards in the raw score form and were transformed therefrom to the IBM cards. Major analyses of the study involved Pearson product moment correlations, multiple R's, and significance of the differences in r's and multiple R's.

Hypothesis 1 (a and b): Raw scores on each test or sub-test for the samples were normalized and converted into T scores, with means of 50 and standard deviations of 10. Correlations were computed between the 1961 predictors and Reading, Arithmetic, Language, and Total achievement scores derived from the California achievement tests in 1965 for the Indian-Metis sample. Similarly correlation coefficients were calculated between the 1962 predictors and Vernon Arithmetic, English, and Vocabulary tests given in 1965 for the two Eskimo sub-samples. Significance levels were found for all r's using a table of critical values of correlation coefficients (Ferguson, 1959, Table F p. 315).

Mean r's with school achievement were calculated for the two samples through Fisher's transformations using a table of

transformation of r to z (Ferguson, 1959, Table E, p. 314).

Differences in correlations of the various predictors with school achievement were tested for significance using the test described in Ferguson (1959) on page 154.

Beta weights were calculated for various combinations of predictors using the techniques described in Ferguson on page 294 for two predictors and using Aitken's method of pivotal condensation for three or more predictors. Multiple correlations were then computed. Multiple R's were corrected for bias using formula 16.7 described in Guilford (1965) on page 401. Differences in R's were investigated for significance using formula 16.11 described in Guilford on page 403. The relative contributions of the various tests toward the prediction of school achievement were pointed out.

Hypothesis 2 (a and b): Correlations of the same or appropriate forms of the tests administered in 1961-62 and 1965 to the Indian-Metis and Eskimo samples were studied for significance using a table of critical values of correlation coefficients (Ferguson, 1959, Table F, p. 315).

Differences in stability coefficients between the culture-reduced and conventional tests were studied for significance. Procedure used was the assumption of null hypothesis for the difference.

Hypothesis 3 (a, b, and c): Pearson product moment

correlations were calculated between the ability tests and background variables such as sex, amount of language other than English used in the home, and occupational level of parents. These correlations were examined for significance and differences were studied.

Hypothesis 3 (d): Differences in correlation with the occupation of parent and the amount of language other than English used in the home for conventional and culture-reduced tests were studied for significance.

Hypothesis 3 (e): 1961-61 and 1965-65 correlations of the conventional tests with the occupation of parent and amount of language other than English used in the home were calculated and the differences in the two correlations were studied.

Hypothesis 3 (f): 1961-61 and 1965-65 correlations of the culture-reduced tests with the occupation of parents and amount of language other than English used in the home were calculated and the differences in the two correlations were studied.

Hypothesis 4 (a and b): Pearson product moment correlations were calculated between the 1965 ability tests and the 1965 school achievement. Correlations were studied for significance using a table of critical values of correlation coefficients (Ferguson, 1959, Table F, p. 315). Mean correlations of the tests with school achievement were calculated through Fisher's z transformation (Ferguson, 1959).

Differences in correlations and mean correlations between the conventional and culture-reduced tests and school achievement were investigated for significance using the test described in Ferguson (1959).

CHAPTER VI

RESULTS: PREDICTIVE VALIDITY AND STABILITY

I. Predictive Validity

Hypothesis I (a): Both conventional and cultural-reduced tests will have long-term predictive validity for the samples involved in this study.

The correlation coefficients of the various mental ability tests administered in 1961 with the normalized standard achievement scores derived from California Achievement Tests administered in 1965 for the Indian-Metis sample are set out in Table VI. All correlations between the predictor variables and the criterion variables are significant at .05 and .01 levels if they are equal to or greater than .249 and .346 respectively. These values of r's were obtained by interpolation for 43 degrees of freedom, and for one tail test.

As the normalized scores of mental ability tests are not directly comparable to the I.Q. scores, it was decided to examine their correlations with the school achievement separately. These correlations are indicated in Tables VII and VIII respectively.

Examination of Table VII reveals that all correlations are significant at .01 level with the exception of the correlation

of CTMM Spatial with CTMM Language which fails to meet significance even at .05 level. Mean correlations of the ability tests with California Achievement tests (based on Reading, Arithmetic and Language scores) are all significant at .01 level.

Table VIII indicates that Lorge-Thorndike I.Q. and CTMM Non-language I.Q. do not correlate significantly at .05 level with all the four achievement scores. Mean correlations of all the I.Q.'s with the achievement tests, however, are all significant, majority of them at the .01 level.

Table IX reports the correlation coefficients of the ability tests administered in 1962 with the Vernon Achievement tests administered in 1965 for the two Eskimo sub-samples. Correlations equal to or greater than .295 or .381 are required for significance at .01 level for sub-samples 2 (a) and 2 (b) respectively. It is seen that all correlation coefficients are significant at .01 level.

Thus evidence presented in Tables VII, VIII and IX overwhelmingly upholds hypothesis 1 (a) for the Indian-Metis and Eskimo samples involved in this study.

Hypothesis 1 (b): Conventional tests will have higher predictive validity than the culture-reduced tests for the Indian-Metis sample.

Significance levels of differences in correlation coefficients with California Achievement scores for conventional and culture-reduced tests are presented in Tables X, XI, XII, XIII, and XIV for the Indian-Metis sample.

Table X indicates very few significant differences between the conventional and culture-reduced tests in predicting Reading scores over an interval of four years for this sample. CTMM Language and CTMM Total have significantly higher predictive validity than has CTMM Spatial.

Table XI reveals that the conventional CTMM Language and CTMM Total are superior to the culture-reduced tests in predicting Arithmetic scores. The I.Q.'s based on the conventional tests however, do not prove superior to their culture-reduced counterparts in this regard.

Tables XII and XIII indicate that the conventional tests do not have significantly higher predictive validity than the culture-reduced colored Progressive Matrices and SCRIT in predicting California Language and Total scores over an interval of four years for the Indian-Metis sample. Some of the conventional tests, however, are indicated to have significantly higher predictive validity than CTMM Spatial and CTMM Non-Language.

Table XIV presents the significance levels of differences in mean correlations with the three school subjects for conventional and culture-reduced tests. Examination of the Table reveals very few significant differences between the conventional and culture-reduced tests in predicting mean school achievement over an interval of four years for the Indian-Metis sample. CTMM Total has significantly higher predictive validity than CTMM Spatial. CTMM Total and CTMM Total I.Q. have significantly higher predictive validity than CTMM Non-language and CTMM Non-language I.Q. respectively.

Thus the evidence presented in Tables X, XI, XII, XIII, and XIV does not support hypothesis 1 (b) in that the culture-reduced tests such as colored Progressive Matrices and SCRIT, by and large, do not differ significantly from the more conventional tests in their long-term predictive validity for the Indian-Metis sample.

TABLE VI

CORRELATION COEFFICIENTS BETWEEN MENTAL ABILITY TESTS ADMINISTERED IN 1961 AND NORMALIZED STANDARD ACHIEVEMENT SCORES DERIVED FROM CALIFORNA ACHIEVEMENT TESTS ADMINISTERED IN 1961 FOR THE INDIAN-METIS SAMPLE. (N =45)

Test or sub-test	Reading	Arithmetic	Language	Total
Detroit I.Q.	.373	.373	.433	.419
L. Th. I.Q.	.241	.224	.396	.300
CTMM Verbal	.575	.513	.458	.541
CTMM Logical	.539	.607	.504	.592
CTMM Numerical	.586	.649	.394	.522
CTMM Language	.698	.738	.564	.683
CTMM Lang. I.Q.	.458	.386	.464	.477
CTMM Total	.704	.706	.496	.645
CTMM Total I.Q.	.449	.334	.397	.434
Toga I.Q.	.452	.389	.485	.496
Prog. Mat. I.Q.	.437	.301	.484	.471
Prog. Mat.	.573	.519	.491	.574
Scrit	.603	.560	.574	.623
CTMM Spatial	.479	.389	.236	.374
CTMM Non-Lang.	.587	.541	.366	.504
CTMM Non-Lang. I.Q.	.354	.211	.242	.299

$r \geq .249$ significant at .05 level
$r \geq .346$ significant at .01 level

TABLE VII

CORRELATION COEFFICIENTS BETWEEN NORMALIZED SCORES OF ABILITY TESTS ADMINISTERED IN 1961 AND NORMALIZED STANDARD ACHIEVEMENT SCORES DERIVED FROM CALIFORNIA ACHIEVEMENT TESTS ADMINISTERED IN 1965 FOR THE INDIAN-METIS SAMPLE (N = 45)

Test or Sub-test	Reading	Arithmetic	Language	Mean	Total
Progressive Matrices	.573	.519	.491	.528	.574
Scrit	.603	.560	.574	.580	.623
CTMM Spatial	.479	.389	.236	.373	.374
CTMM Non-Lang.	.587	.541	.366	.505	.504
CTMM Logical	.539	.607	.504	.552	.592
CTMM Numerical	.586	.649	.394	.551	.522
CTMM Verbal	.575	.513	.458	.517	.541
CTMM Lang.	.698	.738	.564	.673	.683
CTMM Total	.704	.706	.496	.645	.645

$r \geq .249$ significant at .05 level
$r \geq .346$ significant at .01 level

TABLE VIII

CORRELATION COEFFICIENTS BETWEEN MENTAL ABILITY I.Q'S OBTAINED IN 1961 AND NORMALIZED STANDARD SCORES DERIVED FROM CALIFORNIA ACHIEVEMENT TESTS ADMINISTERED IN 1965 FOR THE INDIAN-METIS SAMPLE (N=45)

Test - I.Q.'s	Reading	Arithmetic	Language	Mean	Total
Detroit B.I.Q.	.373	.373	.433	.393	.419
L. Th. I.Q.	.241	.224	.396	.289	.300
P.M. I.Q.	.437	.301	.484	.410	.471
CTMM Lang. I.Q.	.458	.386	.464	.436	.477
CTMM N-Lang. I.Q.	.354	.211	.242	.270	.299
CTMM Total I.Q.	.449	.334	.397	.394	.434
Toga I.Q.	.452	.389	.485	.442	.496

$r \geq .249$ significant at .05 level
$r \geq .346$ significant at .01 level

TABLE IX

CORRELATION COEFFICIENTS BETWEEN THE 1962 PREDICTORS AND VERNON ACHIEVEMENT TESTS ADMINISTERED IN 1965 FOR THE TWO ESKIMO SUB-SAMPLES

Sample	Tests	V. Arith.	V. Eng.	V. Voc.	Mean r
Sub-sample 2 (a) N = 62	Cld. P.M.	.454	.424	.424	.434
	Otis Alpha	.688	.588	.613	.632
Sub-sample 2 (b) N = 37	Std. P.M.	.694	.618	.489	.607
	L. Th.NV Level 3	.713	.711	.657	.694

$r \geq .295$ significant at .01 level for sub-sample 2 (a)
$r \geq .381$ significant at .01 level for sub-sample 2 (b)

TABLE X

SIGNIFICANCE LEVELS OF DIFFERENCES IN CORRELATION CO-EFFICIENTS WITH CALIFORNIA READING SCORES FOR CONVENTIONAL AND CULTURE-REDUCED TEST SCORES AND I.Q'S FOR THE INDIAN-METIS SAMPLE N = 45

Conventional Tests		Culture-Reduced Tests			
		Cld. P.M. .573	Scrit .603	CTMM Spat. .479	CTMM N-L .587
CTMM Log.	.537	--	--	--	--
CTMM Num.	.586	--	--	--	--
CTMM Verb.	.575	--	--	--	--
CTMM Lang.	.698	--	--	*	--
CTMM Total	.704	--	--	*	--

Conventional I.Q's		Culture-Reduced I.Q.'s	
		Cld. P.M. I.Q. .437	CTMM N-L I.Q. .354
Detroit B. I.Q.	.373	--	--
L. Th. I.Q.	.241	--	--
CTMM Lang. I.Q.	.458	--	--
CTMM Total I.Q.	.449	--	--
Toga I.Q.	.452	--	--

-- not significant at .05 level
* significant at .05 level

TABLE XI

SIGNIFICANCE LEVELS OF DIFFERENCES IN CORRELATION COEFFICIENTS WITH CALIFORNIA ARITHMETIC SCORES FOR CONVENTIONAL AND CUTLURE-REDUCED TEST SCORES AND I.Q'S FOR THE INDIAN-METIS SAMPLE N=45

Conventional Tests	Culture-Reduced Tests			
	Cld. P.M. .519	Scrit .560	CTMM Spat. .389	CTMM N-L .541
CTMM Log. .607	--	--	--	--
CTMM Num. .649	--	--	*	--
CTMM Verb. .513	--	--	--	--
CTMM Lang. .738	*	*	*	*
CTMM Total .706	*	*	*	*

Conventional I.Q.'s	Culture-reduced I.Q.'s	
	Cld. P.M. I.Q. .301	CTMM N-L I.Q. .211
Detroit B. I.Q. .373	--	--
L. Th. I.Q. .224	--	--
CTMM Lang. I.Q. .386	--	--
CTMM Total I.Q. .334	--	--
Toga I.Q. .389	--	--

-- not significant at .05 level
* significant at .05 level

TABLE XII

SIGNIFICANCE LEVELS OF DIFFERENCES IN CORRELATION COEFFICIENTS WITH CALIFORNIA LANGUAGE SCORES FOR CONVENTIONAL AND CULTURE-REDUCED TEST SCORES AND I.Q.'S FOR THE INDIAN-METIS SAMPLE
N = 45

Conventional Tests		Culture-reduced Tests			
		Cld. P.M. .491	Scrit .574	CTMM Spat. .236	CTMM N-L .366
CTMM Log.	.504	--	--	*	--
CTMM Num	.394	--	--	--	--
CTMM Verb.	.458	--	--	--	--
CTMM Lang.	.564	--	--	**	*
CTMM Total	.496	--	--	**	*
Conventional I.Q.'s		**Culture-reduced I.Q.'s**			
		Cld. P.M. I.Q. .484			CTMM N-L I.Q. .242
Detroit B. I.Q.	.433	--			--
L.Th. I.Q.	.396	--			--
CTMM Lang. I.Q.	.464	--			*
CTMM Total I.Q.	.397	--			**
Toga I.Q.	.485	--			*

-- not significant at .05 level
* significant at .05 level
** significant at .01 level

TABLE XIII

SIGNIFICANCE LEVELS OF DIFFERENCES IN CORRELATION COEFFICIENTS WITH CALIFORNIA TOTAL SCORES FOR CONVENTIONAL AND CULTURE-REDUCED TEST SCORES AND I.Q'S FOR THE INDIAN-METIS SAMPLE N = 45

Conventional Tests	Culture-reduced Tests			
	Cld. P. M. .574	Scrit .623	CTMM Spat. .374	CTMM N-L .504
CTMM Log. .592	--	--	--	--
CTMM Num. .522	--	--	--	--
CTMM Verb. .541	--	--	--	--
CTMM Lang. .683	--	--	**	*
CTMM Total .645	--	--	**	*

Conventional I.Q's	Culture-reduced I.Q's	
	Cld. P. M. I.Q. .471	CTMM N-L I.Q. .299
Detroit B. I.Q. .419	--	--
L. Th. I.Q. .300	--	--
CTMM Lang. I.Q. .477	--	--
CTMM Total I.Q. .434	--	*
Toga I.Q. .496	--	--

-- not significant at .05 level
* significant at .05 level
** significant at .01 level

TABLE XIV

SIGNIFICANCE LEVELS OF DIFFERENCES IN MEAN CORRELATION COEFFICIENTS WITH CALIFORNIA ACHIEVEMENT SCORES (BASED ON READING, ARITHMETIC AND LANGUAGE) FOR CONVENTIONAL AND CULTURE-REDUCED TEST SCORES AND I.Q.'S FOR THE INDIAN-METIS SAMPLE N = 45

Conventional Tests	Culture-reduced Tests			
	Cld. P. M. .528	Scrit .580	CTMM Spat. .373	CTMM N-L .505
CTMM Log. .552	--	--	--	--
CTMM Num. .551	--	--	--	--
CTMM Verb. .517	--	--	--	--
CTMM Lang. .673	--	--	**	--
CTMM Total .645	--	--	**	*

Conventional I.Q.'s	Culture-reduced I.Q.'s		
	Cld. P. M. I.Q. .410	CTMM N-L I.Q. .270	
Detroit B. I.Q. .393	--	--	
L. Th. I.Q. .289	--	--	
CTMM Lang. I.Q. .436	--	--	
CTMM Total I.Q. .394	--	*	
Toga Total I.Q. .442	--	--	

-- not significant at .05 level
* significant at .05 level
** significant at .01 level

II Stability

Hypothesis 2 (a): Both conventional and culture-reduced tests will have significant stability coefficients over an interval of 3-4 years for the samples involved in this study.

Pearson product moment correlations between the same or corresponding tests administered in 1961 and 1965 for the Indian-Metis sample are reported in Table XV. All Stability coefficients are significant at .01 level with the exception of the coefficient of CTMM Spatial which fails to meet significance even at .05 level.

Table XVI presents correlations between the same or corresponding tests administered in 1962 and 1965 for the two Eskimo subsamples. All stability coefficients are significant at .01 level.

Thus the evidence presented in Tables XV and XVI overwhelmingly supports hypothesis 2 (a) for the Indian-Metis and Eskimo samples.

Hypothesis 2 (b): There will be no significant differences between the stability coefficients of conventional and culture-reduced tests for the Indian-Metis sample.

Significance levels of differences in stability coefficients between the conventional and culture-reduced tests administered four years apart are set out in Table XVII. Data in this table supports the hypothesis for SCRIT and Progressive Matrices (with one exception) but not for CTMM Non-language and CTMM Spatial.

TABLE XV

PEARSON PRODUCT MOMENT CORRELATIONS BETWEEN THE SAME OR CORRESPONDING TESTS OF MENTAL ABILITY ADMINISTERED IN 1961 AND 1965 FOR INDIAN-METIS SAMPLE. N = 45

Culture-reduced Tests		Conventional Tests	
Progressive Matrices	.478	CTMM Logical	.636
Scrit	.598	CTMM Numerical	.525
CTMM Spatial	.203	CTMM Verbal	.576
CTMM Non - Language	.294	CTMM Language	.731
		CTMM Total	.708

TABLE XVI

PEARSON PRODUCT MOMENT CORRELATIONS BETWEEN THE SAME OR CORRESPONDING TESTS OF MENTAL ABILITY ADMINISTERED IN 1962 AND 1965 FOR THE ESKIMO SUB-SAMPLES.

Sub-sample	Tests	
Eskimo 2 (a) N = 62	Progressive Matrices	.384
	Otis	.587
Eskimo 2 (b) N = 37	Progressive Matrices	.769
	Lorge - Thorndike	.739

TABLE XVII

SIGNIFICANCE LEVELS OF DIFFERENCES IN STABILITY COEFFICIENTS BETWEEN THE CONVENTIONAL AND CULTURE-REDUCED TESTS ADMINISTERED FOUR YEARS APART FOR THE INDIAN-METIS SAMPLE
N = 45

Conventional Tests or sub-tests		Culture-reduced Tests			
		P. M. .48	Scrit .60	CTMM N-L .29	CTMM Spat. .20
CTMM Log.	.64	--	--	**	**
CTMM Num.	.53	--	--	--	*
CTMM Verb.	.58	--	--	*	**
CTMM Lang.	.73	*	--	**	**
CTMM Total	.71	--	--	**	**

-- not significant at .05 level
* significant at .05 level
** significant at .01 level

CHAPTER VII

RESULTS: BACKGROUND VARIABLES AND CURRENT SCHOOL ACHIEVEMENT

1. Background Variables

Hypothesis 3 (a): Both conventional and culture-reduced tests administered in 1961-62 to the samples involved in this study will have insignificant correlations with sex in 1965.

Hypothesis 3 (b): Conventional tests (particularly those dependent upon linguistic skills) administered in 1961 to the Indian-Metis sample will have significant positive correlations with the occupation of parent and significant negative correlations with the amount of language other than English used in the home in 1965.

Hypothesis 3 (c): Culture-reduced tests administered in 1961-62 to the samples involved in this study will have insignificant correlations with the occupation of parent and the amount of language other than English used in the home in 1965.

Tables XVIII and XIX report the correlations between the 1961-62 predictors and the 1965 background variables for the Indian-Metis and Eskimo samples respectively. Examination of the Tables indicates that the above hypotheses are upheld for the two samples. It may be noted here that theoretical

considerations led to the use of two tail test for testing hypothesis 3 (c).

Hypothesis 3 (d): Conventional tests (particularly those dependent upon linguistic skills) administered in 1961 to the Indian-Metis sample will have higher positive and negative correlations with the occupation of the parent and the amount of language other than English used in the home respectively than the culture-reduced tests administered at the same time.

Significance levels of differences in correlation coefficients with the two background variables for conventional and culture-reduced tests are presented in Tables XX and XXI for the Indian-Metis sample. Examination of Table XX indicates that CTMM Verbal and CTMM Language have significantly higher correlation with the occupation of parent than the culture-reduced tests. Table XXI indicates only three significant differences, and as such does not strongly support the trend observed in Table XX. However, we may conclude that hypothesis 3 (d) tends to be upheld by the evidence presented here for the Indian-Metis sample.

Hypothesis 3 (e): Correlations of the conventional tests (particularly those dependent upon linguistic skills) with the occupation of parent and the amount of language other than English used in the home will change from 1961 to 1965 for the Indian-Metis sample.

Hypothesis 3 (f): Correlations of the culture-reduced tests with the occupation of the parent and the amount of language other

than English used in the home will not change from 1961-62 to 1965 for the samples involved in this study.

Data presented in Table XXII, by and large, tends to support hypothesis 3 (e) in the sense that correlations of the conventional tests with the two background variables do change from significant values in 1961 to non-significant values in 1965. Hypothesis 3 (f) is also supported by this evidence with one exception. Correlation of SCRIT with the amount of language other than English used in the home changes from insignificant positive value in 1961 to a significant negative value in 1965.

Data reported in Table XXIII supports hypothesis 3 (f) for the Eskimo sub-samples with one exception. Correlation of Otis with the occupation of parent changes from a significant positive value in 1962 to a non-significant positive value in 1965. Although Otis Alpha Nonverbal was classified as a culture-reduced test, yet some of its pictorial items may have appeared culturally biased to the Eskimo children.

TABLE XVIII

CORRELATION COEFFICIENTS BETWEEN THE 1961 PREDICTOR VARIABLES AND 1965 BACKGROUND VARIABLES FOR THE INDIAN-METIS SAMPLE
N = 45

Tests	Sex	Occ. level	Amount of lang. other than English
P.M.	.002	.006	-.280
Scrit	-.111	-.061	-.041
CTMM Spat.	.104	.063	-.100
CTMM N-L	.175	.073	-.165
CTMM Log.	-.036	-.027	-.105
CTMM Num.	.214	.175	-.171
CTMM Verb.	.143	.349*	-.363*
CTMM Lang.	.094	.273*	-.264*
CTMM Total	.157	.209	-.217

*Significant at .05 level

TABLE XIX

CORRELATION COEFFICIENTS BETWEEN THE 1962 PREDICTOR VARIABLES AND 1965 BACKGROUND VARIABLES FOR THE ESKIMO SUB-SAMPLES

Sub-Sample	Tests	Sex	Occupation of Parent
Sub-sample 2 (a) N = 62	P.M.	.023	.109
	Otis	-.024	.033
Sub-sample 2 (b) N = 37	P.M.	-.113	-.053
	L.Th.	-.006	-.021

TABLE XX

SIGNIFICANCE LEVELS OF DIFFERENCES IN CORRELATION COEFFICIENTS WITH THE OCCUPATION OF PARENT FOR THE CONVENTIONAL AND CULTURE-REDUCED TESTS FOR THE INDIAN-METIS SAMPLE. N = 45

Conventional Tests		Culture-Reduced Tests			
		P.M. .006	Scrit -.061	CTMM SPAT. .063	CTMM N-L .073
CTMM Log.	-.027	--	--	--	--
CTMM Num.	.175	--	--	--	--
CTMM Verb.	.349	*	*	*	*
CTMM Lang.	.273	*	*	--	--
CTMM Total	.209	--	--	--	--

* Significant at .05 level -- Not significant at .05 level

TABLE XXI

SIGNIFICANCE LEVELS OF DIFFERENCES IN CORRELATION COEFFICIENTS WITH THE AMOUNT OF LANGUAGE OTHER THAN ENGLISH USED IN THE HOME FOR THE CONVENTIONAL AND CULTURE-REDUCED TESTS FOR THE INDIAN-METIS SAMPLE. N = 45

Conventional Tests		Culture-Reduced Tests			
		P.M. -.280	Scrit -.041	CTMM Spat. -.100	CTMM N-L -.165
CTMM Log.	.105	--	--	--	--
CTMM Num.	-.171	--	--	--	--
CTMM Verb.	-.363	--	*	*	--
CTMM Lang.	-.264	--	*	--	--
CTMM Total	-.217	--	--	--	--

* Significant at the .05 level -- Not significant at .05 level

TABLE XXII

1961-61 AND 1965-65 CORRELATIONS OF THE ABILITY TESTS WITH THE OCC. OF PARENT AND AMOUNT OF LANGUAGE OTHER THAN ENGLISH IN THE HOME FOR THE INDIAN-METIS SAMPLE. N = 45

Tests	Occ. of Parent		Amount of lang. other than English in the home.	
	1961-61	1965-65	1961-61	1965-65
P. M.	.104	.021	.064	-.140
Scrit	-.050	.041	.195	-.314*
CTMM Spat.	.202	.004	.058	-.071
CTMM N-L	.129	.027	.046	-.048
CTMM Log.	.075	.083	-.026	-.113
CTMM Num.	.073	.015	.003	-.107
CTMM Verb.	.371*	.207	-.417**	-.182
CTMM Lang.	.288*	.129	-.262*	-.160
CTMM Total	.235	.121	-.128	-.184

* Significant at .05 level
** Significant at .01 level

TABLE XXIII

1962-62 AND 1965-65 CORRELATION COEFFICIENTS OF THE ABILITY TESTS WITH THE OCCUPATION OF PARENT FOR THE ESKIMO SUB-SAMPLES.

Sub-sample	Tests	Occupation of Parent	
		1962-62	1965-65
Eskimo 2 (a) N = 62	P. M.	.128	-.044
	Otis	.222*	.008
Eskimo 2 (b) N = 37	P. M.	-.045	-.070
	L. Th.	-.034	-.027

* Significant at .05 level

11. Current School Achievement

Hypothesis 4 (a): Culture-reduced tests, administered to the samples involved in this study in 1965, will have moderate correlations with current school achievement. A correlation is considered moderate if it is significantly different from zero and lies between .300 and .600.

Tables XXIV and XXV present the correlations of the 1965 ability tests with the school achievement for the Indian-Metis and Eskimo samples. Mean correlations of the ability tests with school achievement are also indicated in the tables. All correlations are significant for the Indian-Metis sample and Eskimo sub-sample 2 (a). Thus hypothesis 4 (a) is upheld by the evidence from these samples. However, evidence from Eskimo sub-sample 2 (b) does not support the hypothesis completely, for some culture-reduced tests are not significantly related to school achievement.

Hypothesis 4 (b): Conventional tests, administered to the samples involved in this study in 1965, will have higher correlations with the current school achievement than the culture-reduced tests administered at the same time.

Significance levels of the differences in correlation with the current school achievement for the conventional and culture-reduced tests are reported in Tables XXVI to XXXIII inclusive, for the Indian-Metis and Eskimo samples. Examination of the Tables indicates that a number of differences

in correlation are significant in favour of the conventional tests. Thus hypothesis 4 (b), by and large, is substantiated by the evidence presented here for the two samples. However, the culture-reduced tests such as P.M. and L.Th. are indicated to have higher relationship with school achievement than CTMM Logical for the Indian-Metis sample.

It may also be noted here that the culture-reduced tests P.M. and L.Th. do not differ significantly from any of the conventional tests in their mean relationship with current school achievement for the Indian-Metis sample and Eskimo sub-sample 2(b); L.Th. does not differ significantly from any of the conventional tests for the Eskimo sub-sample 2(b) in this regard.

TABLE XXIV

CORRELATION COEFFICIENTS BETWEEN MENTAL ABILITY TESTS AND NORMALIZED STANDARD ACHIEVEMENT SCORES DERIVED FROM CALIFORNIA ACHIEVEMENT TESTS, BOTH ADMINISTERED IN 1965, FOR THE INDIAN-METIS SAMPLE N = 45

Tests	Reading	Arithmetic	Language	Mean	Total
Prog. M.	.628	.727	.650	.670	.704
Scrit	.528	.529	.499	.519	.542
Mac	.343	.427	.351	.375	.410
L. Th.	.670	.685	.642	.661	.738
Cattell	.517	.552	.362	.480	.529
CTMM Spatial	.529	.542	.413	.497	.533
CTMM N-L	.580	.607	.464	.553	.580
Embedded Fig.	.372	.458	.413	.414	.445
CTMM Log.	.384	.442	.412	.413	.448
CTMM Num.	.660	.686	.540	.632	.665
CTMM Verb.	.622	.570	.704	.635	.697
CTMM Lang.	.685	.653	.713	.685	.746
CTMM Total	.763	.784	.704	.752	.805
Let. & N.	.681	.635	.780	.704	.761
Oral Info.	.623	.625	.572	.607	.616

$r \geq .249$ significant at .05 level
$r \geq .346$ significant at .01 level

TABLE XXV

CORRELATION COEFFICIENTS BETWEEN MENTAL ABILITY TESTS AND VERNON ACHIEVEMENT TESTS BOTH ADMINISTERED IN 1965 FOR THE ESKIMO SAMPLE

Ability Tests	Arithmetic	English	Vocabulary	Mean r's
Sub-sample 2(a) N = 62				
Prog. M.	.569	.470	.417	.487
Scrit	.471	.374	.379	.408
Mac	.600	.534	.529	.589
L. Th.	.713	.620	.586	.642
Cattell	.472	.414	.363	.417
Otis	.774	.715	.728	.740
Letters & Numbers	.646	.690	.475	.611
Oral Information	.742	.781	.626	.722
Embedded Fig.	.645	.479	.509	.549
Sub-sample 2(b) N = 37				
Prog. M.	.712	.682	.580	.661
Scrit	.276	.259	.139	.225
Mac	.314	.282	.087	.230
L. Th.	.747	.644	.569	.660
Cattell	.244	.292	.256	.265
Otis	.756	.855	.710	.781
Letters & Numbers	.817	.770	.585	.738
Oral Inf.	.755	.818	.787	.788
Embedded Fig.	.720	.730	.714	.722

$r \geq .295$ significant at .01 level for sub-sample 2 (a)
$r \geq .275$ and .381 significant at .05 and .01 levels respectively for sub-sample 2 (b)

TABLE XXVI

SIGNIFICANCE LEVELS OF DIFFERENCES IN CORRELATIONS WITH CALIFORNIA READING SCORES FOR CONVENTIONAL AND CULTURE-REDUCED TESTS FOR THE INDIAN-METIS SAMPLE N = 45

Conventional Tests		Culture-reduced Tests					CTMM	CTMM	
		P.M.	Scrit	Mac	L. Th.	Catt.	Spat	N-L	Emb. F.
		.628	.528	.343	.670	.517	.529	.580	.372
CTMM Log.	.384	*	--	--	**	--	--	--	--
CTMM Num.	.660	--	--	*	--	--	--	--	*
CTMM Verb.	.622	--	--	*	--	--	--	--	*
CTMM Lang.	.685	--	--	**	--	--	--	--	**
CTMM Total	.763	--	**	**	--	**	**	**	**
Lett. & N.	.681	--	--	**	--	--	--	--	**
Oral Info.	.623	--	--	*	--	--	--	--	*

-- Not significant at .05 level
* Significant at .05 level
** Significant at .01 level

TABLE XXVII

SIGNIFICANCE LEVELS OF DIFFERENCES IN CORRELATIONS WITH CALIFORNIA ARITHMETIC SCORES FOR CONVENTIONAL AND CULTURE-REDUCED TESTS FOR THE INDIAN-METIS SAMPLE. N = 45

Conventional Tests		Culture-reduced Tests							
		P. M. .727	Scrit .529	Mac .477	L. Th. .658	Catt. .552	CTMM Spat. .542	CTMM N-L .607	Emb. F. .458
CTMM Log.	.442	**	--	--	*	--	--	--	--
CTMM Num.	.686	--	--	*	--	--	--	--	*
CTMM Verb.	.570	--	--	--	--	--	--	--	--
CTMM Lang.	.653	--	--	*	--	--	--	--	--
CTMM Total	.784	--	**	**	--	**	**	**	**
Lett. & N.	.635	--	--	--	--	--	--	--	--
Oral Info.	.625	--	--	--	--	--	--	--	--

-- Not significant at .05 level
* Significant at .05 level
** Significant at .01 level

TABLE XXVIII

SIGNIFICANCE LEVELS OF DIFFERENCES IN CORRELATIONS WITH CALIFORNIA LANGUAGE SCORES FOR CONVENTIONAL AND CULTURE-REDUCED TESTS FOR THE INDIAN-METIS SAMPLE. N = 45

Conventional Tests		Culture-reduced Tests					CTMM	CTMM	
		P.M. .650	Scrit .499	Mac .351	L. Th. .642	Catt. .362	Spat .413	N-L .464	Emb. F. .413
CTMM Log.	.412	*	--	--	*	--	--	--	--
CTMM Num.	.540	--	--	--	--	--	--	--	--
CTMM Verb.	.704	--	*	**	--	**	**	**	*
CTMM Lang.	.713	--	*	**	--	**	**	**	**
CTMM Total	.704	--	*	**	--	**	**	**	**
Lett. & N.	.780	--	**	**	--	**	**	**	**
Oral Info.	.572	--	--	--	--	--	--	--	--

-- Not significant at .05 level
* Significant at .05 level
** Significant at .01 level

TABLE XXIX

SIGNIFICANCE LEVELS OF DIFFERENCES IN CORRELATION WITH CALIFORNIA TOTAL ACHIEVEMENT SCORES FOR CONVENTIONAL AND CULTURE-REDUCED TESTS FOR THE INDIAN-METIS SAMPLE. N = 45

Conventional Tests		Culture-reduced Tests					CTMM	CTMM	
		P. M.	Scrit	Mac	L. Th.	Catt.	Spat	N-L	Emb. F.
		.704	.542	.410	.738	.529	.533	.580	.445
CTMM Log.	.448	*	--	--	**	--	--	--	--
CTMM Num.	.665	--	--	**	--	--	--	--	*
CTMM Verb.	.697	--	--	**	--	--	--	--	*
CTMM Lang.	.746	--	*	**	--	*	*	*	**
CTMM Total	.805	--	**	**	--	**	**	**	**
Lett. & N.	.761	--	*	**	--	*	*	*	**
Oral Info.	.616	--	--	--	--	--	--	--	--

-- Not significant at .05 level
* Significant at .05 level
** Significant at .01 level

TABLE XXX

SIGNIFICANCE LEVELS OF DIFFERENCES IN CORRELATIONS WITH VERNON ARITHMETIC, ENGLISH AND VOCABULARY RESPECTIVELY FOR CONVENTIONAL AND CULTURE-REDUCED TESTS FOR THE ESKIMO SUB-SAMPLE 2 (a) N = 62

Conventional Tests		Culture-reduced Tests					
		P.M. .569	Scrit .471	Mac .600	L. Th. .713	Cattell .472	Emb. Fig. .645
Otis	.774	*	*	*	--	*	--
Let. & N.	.646	--	--	--	--	*	--
Oral Info.	.742	*	*	--	--	*	--
		P.M. .470	Scrit .374	Mac .534	L. Th. .620	Cattell .414	Emb. Fig. .479
Otis	.715	*	*	*	--	*	*
Let. & N.	.690	*	*	--	--	*	*
Oral Info.	.781	*	*	*	*	*	*
		P.M. .417	Scrit .379	Mac .529	L. Th. .586	Cattell .363	Emb. Fig. .509
Otis	.728	*	*	*	*	*	*
Let. & N.	.475	--	--	--	--	--	--
Oral Info.	.626	*	*	--	--	*	--

-- Not significant at .05 level. * Significant at .05 level

TABLE XXXI

SIGNIFICANCE LEVELS OF DIFFERENCES IN CORRELATIONS WITH VERNON ARITHMETIC, ENGLISH, AND VOCABULARY SCORES RESPECTIVELY FOR CONVENTIONAL AND CULTURE-REDUCED TESTS FOR THE ESKIMO SUB-SAMPLE 2 (b) N = 37

Conventional Tests		Culture-reduced Tests					
		P. M. .712	Scrit .276	Mac .314	L. Th. .747	Cattell .244	Emb. Fig. .720
Otis	.756	--	**	**	--	**	--
Let. & N.	.817	--	**	**	--	**	--
Oral Info.	.755	--	**	**	--	**	--
		P. M. .682	Scrit .259	Mac .282	L. Th. .644	Cattell .292	Emb. Fig. .732
Otis	.855	*	**	**	**	**	--
Let. & N.	.770	--	**	**	--	**	--
Oral Info.	.818	--	**	**	*	**	--
		P. M. .580	Scrit .39	Mac .087	L. Th. .569	Cattell .256	Emb. Fig. .714
Otis	.710	--	**	**	--	**	--
Let. & N.	.585	--	**	**	--	**	--
Oral Info.	.787	*	**	**	*	**	--

-- not significant at .05 level
* not significant at .05 level
** significant at .01 level

TABLE XXXII

SIGNIFICANCE LEVELS OF DIFFERENCES IN MEAN CORRELATIONS WITH CURRENT SCHOOL ACHIEVEMENT FOR CONVENTIONAL AND CULTURE-REDUCED TESTS FOR INDIAN-METIS SAMPLE. N = 45

Conventional Tests		Culture-reduced Tests					CTMM	CTMM	
		P.M.	Scrit	Mac	L. Th.	Catt.	Spat.	N-L	Emb. F.
		.670	.519	.375	.661	.480	.497	.553	.414
CTMM Log.	.413	*	--	--	*	--	--	--	--
CTMM Num.	.632	--	--	*	--	--	--	--	--
CTMM Verb.	.635	--	--	*	--	--	--	--	*
CTMM Lang.	.685	--	*	**	--	*	--	--	*
CTMM Total	.752	--	**	**	--	**	**	**	**
Lett. & N.	.704	--	*	**	--	*	*	--	**
Oral Info.	.607	--	--	*	--	--	--	--	--

-- not significant at .05 level
* significant at .05 level
** significant at .01 level

TABLE XXXIII

SIGNIFICANCE LEVELS OF DIFFERENCES IN MEAN CORRELATIONS WITH CURRENT SCHOOL ACHIEVEMENT FOR CONVENTIONAL AND CULTURE-REDUCED TESTS FOR THE ESKIMO SUB-SAMPLES

Conventional Tests		Culture-reduced Tests					
Sub-sample 2 (a) N = 62		P. M. .487	Scrit .408	Mac .589	L. Th. .642	Cattell .417	Emb. Fig. .549
Otis	.740	**	**	*	--	**	*
Let. & N.	.611	--	*	--	--	*	--
Oral Info.	.722	**	**	--	--	**	*
Sub-sample 2 (b) N = 37		P. M. .661	Scrit .225	Mac .230	L. Th. .660	Cattell .265	Emb. Fig. .722
Otis	.781	--	**	**	--	**	--
Let. & N.	.738	--	**	**	--	**	--
Oral Info.	.788	--	**	**	--	**	--

-- not significant at .05 level
* significant at .05 level
** significant at .01 level

CHAPTER VIII

ADDITIONAL INFORMATION

1. Multiple Correlations

Multiple correlation coefficent of two or more predictors with California Total Achievement scores for the Indian-Metis sample are examined in this section. It will be recalled that multiple correlation deals with the calculation of weights which produce the maximum possible correlation between a criterion variable and the weighted sum of the two or more predictor variables.

Tables XXXIV and XXXV set out the multiple correlations of the various combinations of the predictors with California Total Achievement scores for the Indian-Metis sample. F values and significance levels for the increases in predictive validity brought about by the various combinations are reported in Table XXXVI. Examination of the Table indicates that several combinations of I.Q's and ability scores bring about increases in predictive validity that are significant. A finding of particular interest in this investigation is, that the culture-reduced I.Q. based on Progressive Matrices, increases significantly the predictive validity of the conventional I.Q's based on Lorge-Thorndike and Detroit Beginning; and that SCRIT adds significantly to the predictive validity of CTMM Total and Progressive Matrices.

TABLE XXXIV

MULTIPLE CORRELATIONS OBTAINED FROM VARIOUS COMBINATIONS OF THE 1961 I.Q'S TO PREDICT CALIFORNIA TOTAL ACHIEVEMENT SCORES IN 1965 FOR THE INDIAN-METIS SAMPLE. N=45

TESTS	Tests Added	Multiple R	Corrected R
CTMM Total I.Q. (.43)	P.M.	.50	.48
	Toga	.62	.61
L. Th. I.Q. (.30)	P.M.	.50	.48
	CTMM N-L	.36	.33
Detroit I.Q. (.42)	P.M.	.52	.50
	Toga	.52	.50
	CTMM N-L	.49	.47
	P.M. + CTMM N-L	.52	.48
CTMM Lang. I.Q. (.48)	P.M.	.54	.53
	Toga	.53	.52
	P.M. + Toga	.56	.53
	P.M. + Detroit	.59	.57
P.M. I.Q. (.47)	Toga	.54	.52

TABLE XXXV

MULTIPLE CORRELATION COEFFICIENTS OBTAINED BY VARIOUS COMBINATIONS OF THE 1961 MENTAL ABILITY TESTS TO PREDICT CALIFORNIA TOTAL ACHIEVEMENT SCORES IN 1965 FOR THE INDIAN-METIS SAMPLE. N = 45

Tests	Tests Added	Multiple R	Corrected R
CTMM Total (.65)	Prog. M.	.67	.66
	Scrit	.69	.685
CTMM Lang. (.68)	CTMM N-L	.70	.69
	P.M.	.71	.70
	Scrit	.72	.71
	P.M. + N-L	.71	.69
	Scrit + N-L	.72	.70
	P.M. + Scrit + N.L.	.73	.71
P.M. (.57)	Scrit	.66	.65
	Scrit + N-L	.67	.65

TABLE XXXVI

F VALUES AND SIGNIFICANCE LEVELS FOR THE DIFFERENCES IN CORRELATIONS BROUGHT ABOUT BY VARIOUS COMBINATIONS OF TESTS TO PREDICT CALIFORNIA TOTAL ACHIEVEMENT SCORES FOR THE INDIAN-METIS SAMPLE. N = 45

Tests	Tests Added	Corrected R	F Values	Lev. Sig.
CTMM Total I.Q. (.43)	P.M. I.Q.	.48	3.8	--
	Toga I.Q.	.62	12.6	**
L. Th. I.Q. (.30)	P.M. I.Q.	.48	7.6	**
	CTMM N-L I.Q.	.47	2.4	--
Detroit I.Q. (.42)	P.M. I.Q.	.50	4.1	*
	Toga I.Q.	.50	4.1	*
CTMM Lang. I.Q. (.48)	P.M. I.Q.	.53	2.9	--
	Toga I.Q.	.52	2.3	--
	P.M. I.Q. and Detroit I.Q.	.57	3.2	--
P.M. I.Q. (.47)	Toga	.52	3.5	--
CTMM Total (.65)	P.M.	.66	1.8	--
	Scrit	.69	4.8	*
CTMM Lang. (.68)	P.M.	.70	2.5	--
	Scrit	.71	3.2	--
P.M. (.57)	Scrit	.66	8.1	**
	Scrit + N-L	.65	3.5	*

-- not significant at .05 level. * significant at .05 level.
** significant at .01 level.

II. Extent of Cultural Bias

The present Indian-Metis sample (N = 45) is highly representative of the 1961 parent sample (N = 74) from which it was derived; consequently it was decided to report MacArthur and West (1962) findings on the parent sample with respect to the cultural bias present in the 1961 predictors. Tables XXXVII and XXXIX give the mean Calgary T scores, standard deviations, and standard error of mean for the various tests for Faust grade 1 and grades 2-3 Indian-Metis of 1961 respectively. The difference between the Faust mean of a test and the corresponding Calgary mean of 50 in units of the standard deviations of the Calgary T score distribution is also reported in the column headed 'δ- deviation'. The number in this column may be interpreted as indicating the relative extent of cultural bias in the tests.

Tables XXXVIII and XL present a matrix of all possible differences between the means of the tests for the Faust Indian-Metis grade 1 and grade 2 and 3 respectively. The significant differences are indicated by asterisks. Perusal of the Tables indicates that the culture-reduced tests such as SCRIT, L. Th. sub-tests II and III, CTMM Spat., CTMM N-L, and P.M. are significantly less biased against the two grade groups than are the conventional tests.

TABLE XXXVII

FAUST GRADE I TEST BATTERY WITH MEASURES BASED ON CALGARY GRADE I T SCORES. N = 32

Test or sub-test		Mean	S.D.	S.E.$_m$	δ- dev.
L. Th. I (Oral Vocabulary)	C	37.5	8.4	1.485	-1.25
L. Th. II (Cross Out)	R	44.5	8.2	1.450	- .55
L. Th. III (Pairing)	R	43.4	9.8	1.733	- .66
L. Th. Total	C	39.4	7.7	1.361	-1.06
Coloured P. M.	R	41.4	6.9	1.220	- .86
Scrit	R	48.5	5.9	1.043	-. 15
Detroit B I. Q.	C	35.0	4.2	.743	-1.50

Classification: C - Conventional
R - Culture-reduced

(From West, 1962, p. 55)

TABLE XXXVIII

DIFFERENCES BETWEEN MEANS: FAUST SAMPLE GRADE I

Test or sub-test	L. Th. I	L. Th. Total	P. M.	L. Th. III	L. Th. II	Scrit
Detroit B.	2.5	4.4*	6.3*	8.4*	9.5*	13.5*
L. Th. I	-	1.9	3.8	5.9*	7.7*	11.0*
L. Th. Total		-	1.9	4.0*	5.1*	9.1*
P. M.			-	2.1	3.2	7.2*
L. Th. III				-	1.1	5.1*
L. Th. II					-	4.0*

* Significant at the .01 level

(From West, 1962, p. 56)

TABLE XXXIX

FAUST GRADE 2 AND 3 TEST BATTERY WITH MEASURES BASED ON CALGARY GRADE 3 T SCORES. N = 42

Test or sub-test		Mean	S.D.	$S E_m$	δ Dev.
L. Th. I(Oral Voc.)	C	29.4	7.2	1.111	-2.06
L. Th. II (Cross Out)	R	41.3	8.3	1.281	- .87
L. Th. III (Pairing)	R	45.2	10.1	1.558	- .48
L. Th. Total	C	33.0	9.6	1.481	-1.70
Coloured P.M.	R	35.0	11.1	1.713	-1.50
Scrit	R	38.4	8.7	1.342	-1.16
CTMM - Total	C	29.0	11.5	1.774	-2.10
- Spatial	R	47.6	11.5	1.774	- .24
- Logical	C	35.0	8.5	1.312	-1.50
- Numerical	C	31.9	11.0	1.697	-1.81
- Verbal	C	28.0	8.7	1.342	-2.20
- Language	C	25.5	8.5	1.312	-2.45
- Non-Lang.	R	40.8	12.8	1.975	- .92

Classification: C - Conventional R - Culture-reduced
All statistics based on predicted measures are underlined.

(From West, 1962, p 62)

TABLE XL

DIFFERENCES BETWEEN MEANS: FAUST GRADE 2 AND 3 BATTERY IN CALGARY T SCORES. N = 42

	CTMM Verb	CTMM Total	L.Th I	CTMM Num.	L.Th Total	CTMM Log.	P.M.	Scrit	CTMM N-L	L.Th II	L.Th III	CTMM Spat.
CTMM-Lang	2.5	3.5*	3.9*	6.4*	7.5*	9.5*	9.5*	12.9*	15.3*	15.8*	19.7*	22.1*
CTMM-Verb	-	1.0	1.4	3.9	5.0*	7.0*	7.0*	10.4*	12.8*	13.3*	17.2*	19.6*
CTMM-Total		-	.4	2.9	4.0	6.0*	6.0*	9.4*	11.8*	12.3*	16.2*	18.6*
L.Th.I			-	2.5	3.6*	5.6*	5.6*	9.0*	11.4*	11.9*	15.8*	18.2*
CTMM Num.				-	1.1	3.1	3.1	6.5*	8.9*	9.4*	13.3*	15.7*
L.Th.Total					-	2.0	2.0	5.4*	7.8*	8.3*	12.2*	14.6*
CTMM Log.						-	0.0	3.4*	5.0*	6.3*	10.2*	12.6*
P.M.							-	3.4*	5.8*	6.3*	10.2*	12.6*
Scrit								-	2.4*	12.9*	6.8*	9.2*
CTMM N-L									-	.5	4.4*	6.8*
L.Th.II										-	3.9	6.3*
L.Th.III											-	2.4*

*Differences significant at .01 level

All statistics based on predicted measures are underlined.

(From West, 1962, p 64)

III. Factor Loadings

Carlson (1966) performed factor analysis on the inter-correlation of the various tests administered to the Indian-Metis and Eskimo samples in 1965. It is to be noted that these samples were not the same as the samples used in this study. However, the present samples were included in the main sample used for factor analysis. The results of factor analysis are reported here for general interest as well as for evaluating culture-reduced tests against MacArthur criteria (see postulate 4, p 31).

Tables XLI and XLII present a summary of unrotated principal axes factor loadings for all Indian-Metis and Eskimo sub-samples. Carlson interprets the first loading as a loading on the general intellectual ability factor. Perusal of the Tables indicates that the culture-reduced tests have fairly high 'g' loadings. The range of these loadings for the younger and older groups of the Indian-Metis and Eskimo samples is from .52 to .84 and .49 to .87 respectively.

TABLE XLI

UNROTATED PRINCIPAL AXES FACTOR LOADINGS FOR THE INDIAN-METIS SUB-SAMPLES.

Variable	Indian-Metis 9 - 12 yrs.					Indian-Metis $12\frac{1}{2}$ - $15\frac{1}{2}$ yrs.				
	Factor Loadings					Factor Loadings				
	I	II	III	IV	V	I	II	III	IV	V
1. P.M.	667	310	441			874				
2. Scrit	637			370		833				
3. Mac 2	619					580		-306		
4. L.Th.1	515	512		-411		618			329	
5. L.Th.11	721	375				766				
6. L.Th.111	612	485			410	794				
7. Cattell	618		307			730		-399		
8. Let. & N.	805	320				874				
9. Oral Info.	889					440		624		
10. Emb.Fig.	725					816		361		
11. Cal. Rdg.	915					814		366		
12. Cal. Arith.	937					769				
13. Cal. Lang.	862					780		408		
14. CTMM Lang.	812					816		361		
15. CTMM N-L	698				-511	592			333	

All decimal points omitted.

(Extracted from Carlson, 1966, pp 49-50)

TABLE XLII

UNROTATED PRINCIPAL AXES FACTOR LOADINGS FOR THE ESKIMO SUB-SAMPLES

Variable	Eskimos 9 - 12 yrs.				Eskimo 12½ - 15½ yrs.				
	Factor Loadings				Factor Loadings				
	I	II	III	V	I	II	III	IV	IV
1.P.M.	679	-589			789				
2.Scrit	571	-355	306		520	-487	349		
3.Mac2	609			337	489	-313	453		334
4.L. Th.1	673				606			363	
5.L. Th.11	838				826				
6.L. Th.111	751	-329			680	-417			
7.Cattell	734	-430			478	-643			
8.Otis	743				855				
9.Vernon Arith.	909				894				
10.Mem.wds.	578	363		-317	414				
11.V.Eng.	866				871				-331
12.V.Voc	798	318			729	300			
13.L & N	807				843	373			
14.Oral Inf.	790				715				
15.Emb.Fig.	684	-368			755				

All decimal omitted

(Extracted from Carlson, 1966, pp 47-48)

CHAPTER IX

EVALUATION OF THE CULTURE-REDUCED TESTS

The findings reported in this thesis must now be drawn together in order to evaluate the culture-reduced tests studied. These tests will be evaluated against MacArthur's criteria listed in postulate 4. In view of the aims of the present study, the two most crucial standards of evaluations would appear to be predictive validity and stability of the culture-reduced tests. However, the tests will be evaluated in terms of all the nine criteria by quoting this as well as other relevant studies done at the University of Alberta.

MacArthur Criteria

1. It should largely sample the broad factor of general intellectual ability running through a wide variety of European-American kinds of intellectual tasks, including arithmetic, linguistic, and reading achievement.

The results of factor analysis reported by MacArthur (1962) and Carlson (1966) indicate that most of the culture-reduced tests studied in this investigation appear to meet this criterion for Indian-Metis and Eskimo samples. The range of g loadings reported by MacArthur is : P.M. (coloured) .68-.92, SCRIT .62-87, and CTMM N-L .23-.79. These loadings were extracted from the data on grade 1 and grade 2-3 for the 1961 Indian-Metis sample.

The range of g loadings reported by Carlson is: P.M. (.67-.87), SCRIT (.52-.83), MAC (.50-.62), L.Th.I NV Level 3 (.52-.67), L.Th. II (.72-.83), L.Th. III (.61-.79), Cattell (.49-.73), Emb. Fig. (.68-.82) and CTMM N-L (.59-.70). The Carlson loadings are based on four sub-samples of Indian-Metis and Eskimo children.

2. It should have negligible loadings on verbal, numerical, and other group factors. That is, it should sample general intellectual ability through simple basic symbols not very dependent upon particular previous learnings.

MacArthur factor analysis on the data from grade 2-3 of the 1961 Indian-Metis sample reports no verbal:educational loadings on P.M., SCRIT, and CTMM N-L. However, SCRIT and CTMM N-L are reported to have loadings of .41 and .40 respectively on comprehension of oral English factor for grade 1 of the same sample.

Carlson reports factor loadings other than 'g' for the various culture-reduced tests as follows: P.M. (two for Indian-Metis and one for Eskimo age 9-12; and none for the two groups aged $12\frac{1}{2}$-$15\frac{1}{2}$); SCRIT (one for Indian-Metis and two for Eskimos age 9-12; none for Indian-Metis and two for Eskimos age $12\frac{1}{2}$-$15\frac{1}{2}$); MAC 2 (none for Indian-Metis and one for Eskimos age 9-12; one for Indian-Metis and three for Eskimos age $12\frac{1}{2}$-$15\frac{1}{2}$);L Th. I (two for Indian-Metis and none for Eskimos age 9-12; one each for the two groups age $12\frac{1}{2}$-$15\frac{1}{2}$); L Th. II (one for Indian-Metis age 9-12; none for the other sub-samples); L Th. III (two for

Indian-Metis and 1 for the Eskimos age 9-12; none for Indian-Metis and one for Eskimos age 12½-15½); Cattell (one each for the four sub-samples); Emb. Fig. (none for Indian-Metis and one for Eskimos age 9-12; one for Indian-Metis and none for Eskimos age 12½-15½); CTMM N-L (one each for the two sub-samples of Indian-Metis).

It is seen from the above summary that the culture-reduced tests may meet this criterion better with one age group or sub-sample than another. L.Th. II, Embedded Figures and P.M. seem to meet this criterion less badly than other tests.

3. It should show less difference between cultures than do alternate measures of intelligence.

West (1962) reported the extent of cultural bias present in the various tests used with the 1961 Indian-Metis sample. He found that a given test may satisfy the criterion at one grade level but may fail to do so at another. Examination of Tables XXXVII, XXXVIII, XXXIX, and XL indicates that some culture-reduced tests are relatively less biased against the Indian-Metis pupils than are some others. More specifically the culture-reduced sub-tests of CTMM, L.Th. sub-tests II and III, SCRIT, and P.M. are among the tests that meet this criterion less badly than other tests.

4. It should have moderate relationships with current school achievement.

Data shown in tables XXIV and XXV support the criterion in that all the culture-reduced tests have significant r's with school

achievement, majority of the r's being significant at the .01 level for the Indian-Metis and Eskimo samples. However, culture-reduced tests such as SCRIT, MAC, and Cattell do not meet this criterion for an older group of Eskimo children (see Table XXV (b).)

5. It should show evidence of stability under changed environmental conditions relative to that of alternate measures of intelligence.

Data reported in tables XV, XVI, and XVII indicate that the culture-reduced tests meet this criterion with the exception of CTMM Spatial over an interval of four years for the Indian-Metis sample, and over an interval of three years for the Eskimo sample. The Stability coefficients for the Indian-Metis sample are P.M. (.49); SCRIT (.60); and CTMM N-L (.29); and for the Eskimo sample are: P.M. (.38) and (.77) for sub-sample 2(a) and 2(b) respectively; L.Th. N.V. Level III (.74) for sub-sample 2(b). While these stability coefficients are not as high as would be desired, those for P.M. (with one exception) and SCRIT do not differ significantly from those for more conventional ability tests.

6. It should minimize effects of test sophistication, providing plenty of appropriate practice experience, having directions depending little if at all on language, and being unspeeded.

This criterion was not empirically tested in this investigation. However, the culture-reduced tests such as P.M. SCRIT, MAC

and Embedded Figures would appear to meet this criterion because the directions included extensive teaching periods with a view to helping the students understand the problems and mechanics of recording the answers. Directions relied heavily on gestures and demonstrations. The time limits were so set so that all but the very slow individuals were able to finish.

7. It should be reliable.

The reliability of the various culture-reduced tests is discussed in the chapter on experimental design. All culture-reduced tests would appear to meet this criterion. Reliability data on Embedded Figures was not available.

8. It should be practical and usable from an administrative point of view.

All the culture-reduced tests studied would appear to meet this criterion with the exception of MAC. The handling of test materials for the MAC was a bit cumbersome especially for the younger children.

9. When and if possible, it should show long-term validity as a predictor of success in intellectual tasks when appropriate adaptive intervening treatments have been employed.

Although the main purpose of the investigation was to study the predictive validity of culture-reduced tests yet the criterion as stated was not explored. Nothing out of the ordinary was done for the pupils included in the study during the prediction

interval. They received the usual treatment offered in most schools, although it is somewhat adaptive. However, the results are worthy of consideration.

Tables from VI to XIV inclusive present data on predictive validity of various tests for the two samples involved in this study.

The culture-reduced tests would appear to have long-term predictive validity, the mean correlations with California school achievement for Indian-Metis pupils are: P.M. (.53), SCRIT (.58), CTMM Spat. (.37), CTMM N-L (.51), P.M. I.Q. (.41), and CTMM N-L I.Q. (.27); mean correlations with Vernon school achievement for the Eskimo sub-samples are P.M. (.43) for sub-sample 2(a), P.M. (.61) for sub-sample 2(b), and Lorge-Thorndike (.69) for sub-sample 2(b). For the Indian-Metis sample, with the exception of predicting Arithmetic, the predictive validity coefficients for P.M. and SCRIT did not differ significantly from those for more conventional predictors.

Although culture-reduced tests P.M. and SCRIT would appear to have long-term predictive validity, yet the full implication of criterion #9 must necessarily await further study.

CHAPTER X

SUMMARY, CONCLUSIONS AND IMPLICATIONS

1. Summary

The main purpose of the investigation was to identify culture-reduced tests which would show long-term predictive validity and stability for two samples of Canadian Indian-Metis and Eskimo pupils. Other problems included the study of the relationship of the culture-reduced tests with background variables such as occupation of parent and the amount of language other than English used in the home, and current school achievement. The culture-reduced tests were also examined in terms of MacArthur criteria for evaluation of instruments designed to measure intellectual ability in a variety of cultural settings.

The main sample of the study was the Faust, Alberta Indian-Metis sample. It consisted of 45 pupils of both sexes who were in grades 1-3 at the Faust school in 1961. Representativeness of this sample was discussed. The Eskimo sample consisted of two sub-samples based on age groups. Sub-sample 2(a) (N=62) and Sub-sample 2(b) (N=37) consisted of the pupils who were in the age groups of $6\frac{1}{2}$ to $9\frac{1}{2}$, and 10 to 12 years respectively in 1962 at the Inuvik and Tuktoyaktuk schools, Northwest Territories.

The test instruments used with the samples in 1961-62 and in 1965 were described in Chapter V. Some relatively new tests such as MAC and Vernon tests were included in the batteries.

Measures of school achievement were provided by the California achievement batteries and Vernon achievement tests for the Faust Indian-Metis and Inuvik Tuktoyaktuk Eskimos respectively.

Statistical analyses used to examine the four hypothesis of the study included Pearson product moment correlations, multiple correlations and the investigation of differences in correlation for significance. Most of the variables were normalized before the intercorrelations were computed. Correlations of the ability tests with mean school achievement were derived through Fisher's z function and the differences between the mean r's were also investigated for significance.

II Conclusions

The theory advanced at the beginning of the study has received support from the evidence presented. The culture-reduced tests have shown long-term predictive validity and stability with very few exceptions for the Indian-Metis and Eskimo samples. The superiority of conventional tests over culture-reduced tests in this context is not always substantiated. Culture-reduced tests P.M. and SCRIT, by and large, are indicated to be just as good as the more conventional CTMM Total and Language in their long-term predictive validity and stability. However, they prove inferior to the same conventional tests in the prediction of California Arithmetic scores. The culture-reduced sub-tests of CTMM have been shown to be inferior to the conventional sub-tests of CTMM in this regard.

Culture-reduced tests have shown insignificant correlations with background variables such as occupation of parent and the amount of language other than English used in the home. As expected, the conventional CTMM Verbal and Language have significant correlations with these variables. The relationship of the culture-reduced tests with these variables do not change from 1961 to 1965 whereas the corresponding r's of the conventional tests (Verbal and Language) do change in the same period. There is one exception to this generalization in that the r's of culture-reduced test SCRIT with the amount of language other than English used in the home changes from an insignificant positive value in 1961 to a significant negative value in 1965. This is rather disconcerting especially when one considers that the SCRIT does not depend on the proficiency in the English language. As mentioned before, the CTMM Verbal and Language change their significant relationship with the amount of language other than English in the home in 1961 to a non-significant one in 1965. Perhaps when the children are older, the amount of language spoken at home does not affect the conventional scores too much (but this explanation does not explain the SCRIT relationship with this variable)- the slight difference in coding of amount of language other than English used in the home, in 1961 and in 1965, may have had some effect.

The Otis changes its relationship with Occupation of the parent from a significant value in 1962 to a non-significant

value in 1965 for the Eskimo sub-sample 2(a).

All the culture-reduced tests studied have shown moderate and significant relationship with current school achievement for the Indian-Metis and Eskimo sub-sample 2(a). Culture-reduced tests such as MAC, SCRIT, and Cattell, however, do not support this contention for Eskimo sub-sample 2(b). Relationship of culture-reduced tests such as P.M. and L. Th. with current school achievement is not inferior to similar relationship of more conventional CTMM Total and Language. These latter tests, however, do indicate superiority over some of the other culture-reduced tests in this regard.

III Implications

(a) Theoretical: The culture-reduced tests have been advocated as the least invalid measures of intellectual potential for pupils from culturally handicapped environments. Cronbach (1960) argues that the mental ability tests ought to locate undeveloped potential that novel treatment may bring out. In order that novel treatments may be planned and carried out, there should be a reasonable assurance that the tests indicating potential remain fairly stable over periods of time. If some of these tests also show substantial long term predictive validity, then the feasibility of adaptive treatment programs based on the scores of these tests becomes more realistic and hopeful. The present study has given support to this theoretical reasoning in at least so far as the identification of P.M., SCRIT, Otis Alpha, and L. Th. Non-verbal, Level 3 as the culture-reduced tests showing substantial predictive validity and

stability over a three to four year interval for two samples of Canadian Indian-Metis and Eskimo children.

(b) Practical: The outcome of the present study may have the following implications for the practising counsellor.

1. The culture-reduced tests should form part of a regular testing programme for culturally handicapped children.

2. The culture-reduced tests should be used in the identification of those pupils who may not be performing to the best of their abilites.

3. The culture-reduced tests should be used for improved cross-cultural comparisons.

4. The culture-reduced tests could help the school authorities decide as to which students will be helped most by modified curriculum programs and as such may help in the planning of such programs.

(c) For Further Research: Modern philosophies of education stress the importance of the individual student and the provision of appropriate programmes and/or teaching methods is emphasized to help him realize his potential. There is a great need for studies of the correlation of mental ability tests with success under various methods of instruction and programmes. A test which correlates higher under one method than another is needed if we wish to assign the pupil to the procedure best for him.

Tests identified as showing substantial predictive validity and stability may be further studied in terms of criterions such as practical job performance and success in vocational and technical courses for samples such as used in the present investigation.

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